AIR CONDITIONING HEATING AND VENTILATING

For the Engineer
Engaged in DESIGN
APPLICATION
ESTIMATING
SPECIFICATION
and LAYOUT
for
AIR CONDITIONING
HEATING • VENTILATING
PIPING • PLUMBING

APRIL 1961

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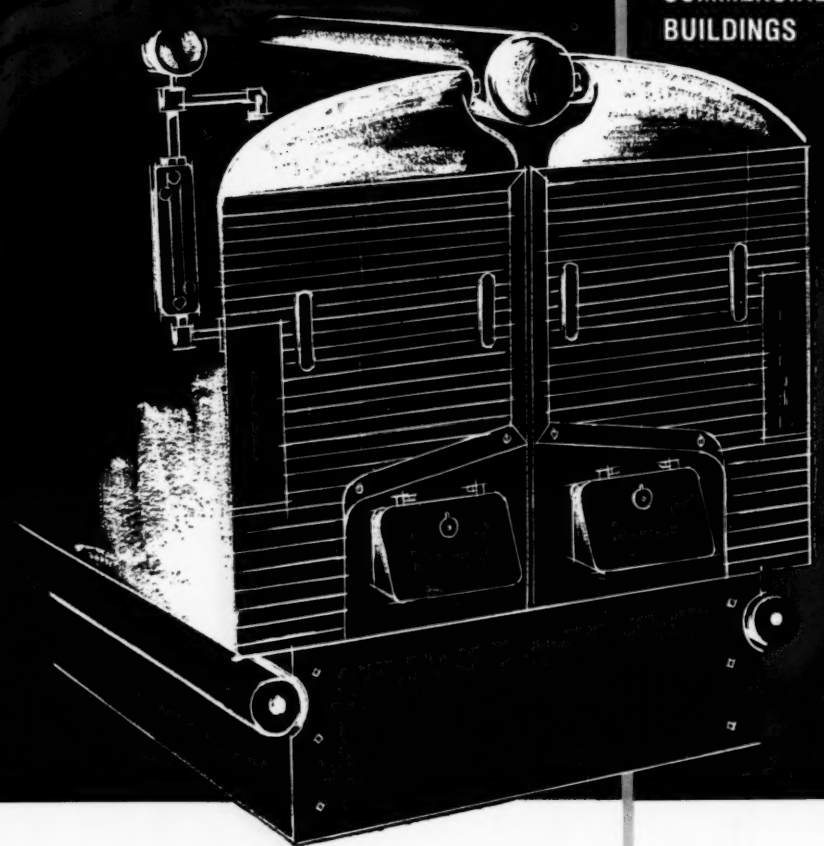
Butter melts but man feels fine in 135-degree F heat of test chamber used to check performance of novel air-conditioned suit developed by Navy and Westinghouse. See page 4.

Announcing...

A NEW OIL OR GAS FIRED, WATER TUBE BOILER FOR SCHOOLS, INSTITUTIONS, COMMERCIAL BUILDINGS



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The result of many years of engineering and testing, the new Mills '450' meets the high standard set by the H. B. Smith-Mills boilers over the years. Its unique features are now ready to help you solve your toughest boiler problems.

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Why Every Steam Heated Unit Needs its Own Steam Trap

. . . the theory, practice and proof of "unit trapping" for top temperatures

Using an individual trap for each steam heated unit, including each separate coil, chest or chamber of a machine—pays off for the user. Here are just two examples:

1. On a creamery dryer

Drainage Method	*Air Temperature*
Restricted Blow-thru	250°
Group trapping (1 trap for 8 coils)	225°
Armstrong Unit Trapping (8 traps—1 for each coil)	**309°**

2. On a platen press

Drainage Method	*Processing Time*
Restricted Blow-thru	50 minutes
Group Trapping	35 minutes
Armstrong Unit Trapping	**25 minutes**

Why Unit Trapping Works Best

It is reasonable to assume that no two steam heated units will have *identical* condensing rates. Even the slightest difference in rate will cause a difference in steam pressure drops through the units. Here's where the trouble starts. Condensate from each unit may flow to the trap. But, what about air and other non-condensibles in the system? A difference in pressure drops too small to be indicated by an ordinary pressure gauge will permit backflow of steam from the higher pressure units to the lower pressure units. This backflow of steam may even impede flow of condensate from the lower pressure unit to the trap . . . and it will definitely impede or block off flow of air to the trap. The result is sluggish heating, reduced temperatures, reduced output, fuel waste and increased possibility of corrosion. Figures 1, 2 and 3 diagram the action.

Unit Trapping Not Costly

No engineer wants any more mechanical devices in his plant than are absolutely necessary. But, the moderate additional cost of using two or more small traps, instead of one big one, is saved over and over again in improved efficiency.

If the traps are Armstrong, maintenance is no problem. And users frequently tell us that Armstrong traps outlast others two and three to one.

Steam traps usually represent a fraction of 1% of the cost of the equipment they drain. Does it make good sense to lose 10% or more of equipment capacity to save a few dollars on traps?

Why not test Armstrong unit trapping in your plant. If you are not completely satisfied with the results you can return the traps for a full refund of the purchase price. There is little to lose—lots to gain. Call your local Armstrong Factory Representative or Distributor, or write **Armstrong Machine Works, 8467 Maple St., Three Rivers, Mich.**

ASK FOR the 44-page Steam Trap Book and reprint of article on Unit Trapping.

801ST

How Different Condensing Rates Can Slow Production

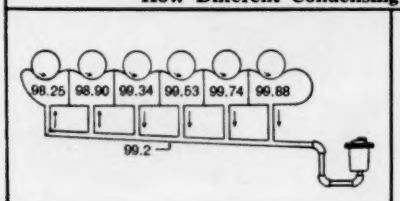


Fig. 1 This is a 6-roll ironer shortly after it has begun operating on 100 psi steam. When cold, wet material passes over chest 1, steam condensing rate is high and pressure drops accordingly. The pressure drop in chest 2 will not be as great, and so on down the machine as the material becomes progressively hotter and drier. Average pressure in the chests then is 99.27 lbs., and drain header pressure is slightly less, about 99.2 lbs. Under these conditions, steam from drain header enters chests 1 and 2 (as indicated by arrows at side of drain lines) because of pressure difference. Though condensate from chests drains by gravity, air can't leave chests countercurrent to incoming steam. Fig. 2 shows what happens next.

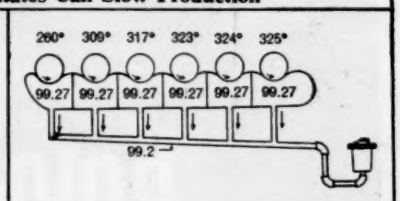


Fig. 2 This is the same 6-roll ironer after it has been operating a while. Air has accumulated in chests 1 and 2, reducing condensing rate and decreasing pressure drop. This process repeats itself down the line until pressures are as shown—that is, enough air will accumulate in each chest so that condensing rates and pressure drops of all chests will be about equal. The net result is shown in chest temperatures which are actual pyrometer readings taken on a 6-roll ironer, drained by a master trap, in a Chicago laundry. The laundry was making 337.9°F steam, but getting an average of only 309.6°F from the ironing surfaces, necessitating slow operation and frequent reruns. Then they tried Armstrong unit trapping—see Fig 3.

How Unit Trapping Prevents Trouble

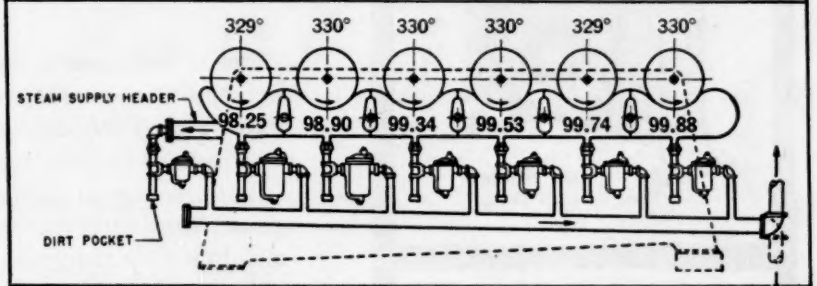
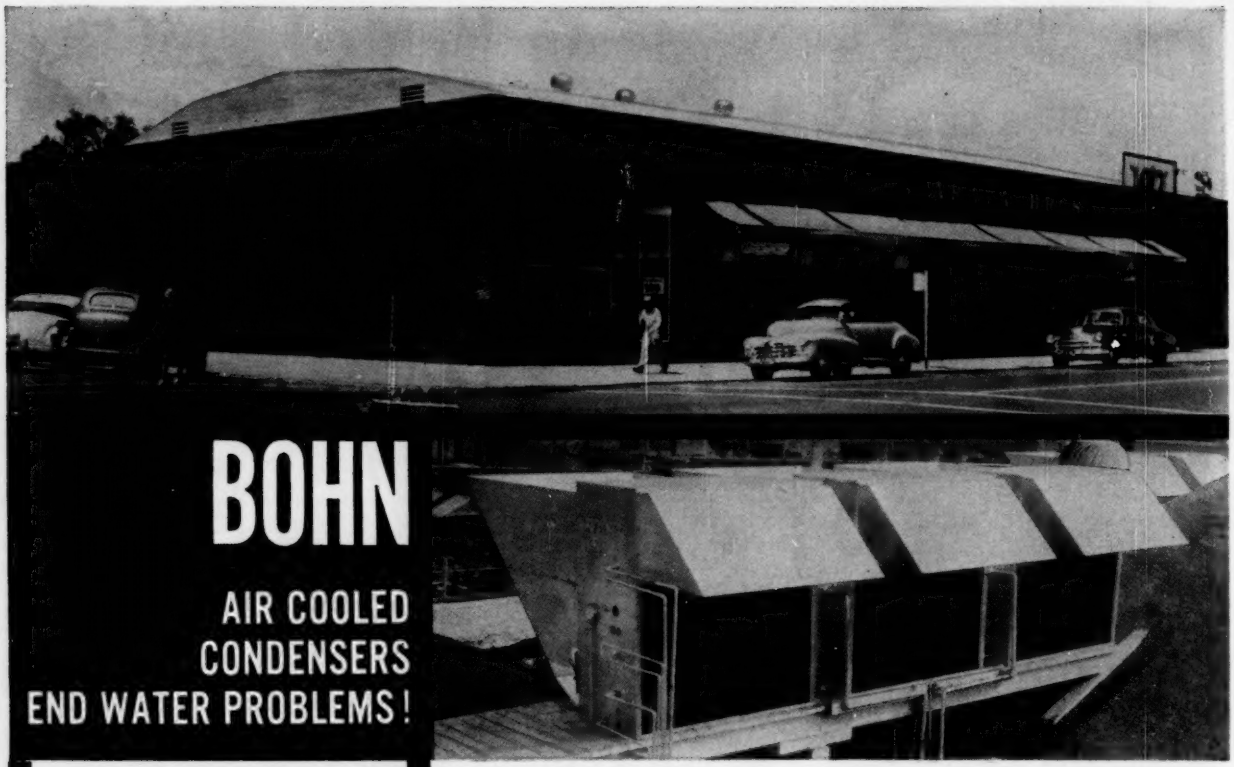


Fig. 3 This is the same 6-roll ironer, now unit trapped. Temperatures shown are also actual pyrometer readings—the average of 329.6°F is 20° higher than with group trapping. This is because air is continually removed from each chest into the drain header, and cannot get back into any chest.

ARMSTRONG STEAM TRAPS

For more data circle this page number on card at back of book



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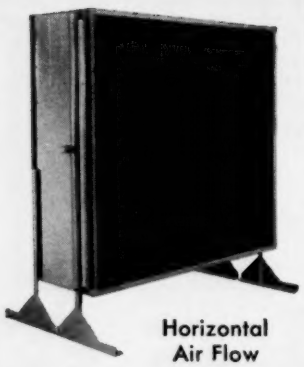

Horizontal Air Flow

Vertical Air Flow

Sacramento Supermarket Saves $200 a Month in Water and Sewerage Bills Alone!

Water in Sacramento, California is hard and it's costly! Arata Brothers Supermarket solved this problem by changing from water cooled condensers to 7 Bohn Air Cooled Condensers. The result was lower maintenance and lower operating costs ... with savings of $200 monthly on sewerage and water bills alone. More importantly, the Bohn Air Cooled Condensers maintain even temperatures in the store's refrigerated equipment *at all times of the year!* Even a high temperature of 114° recorded in 1959 was easily handled by the Bohn Air Cooled Condensers! Whether it's hot or cold, Bohn controls adjust automatically to seasonal weather changes and maintain proper head pressure at all times.

For low first cost ... low operating and maintenance costs, the answer is Bohn Air Cooled Condensers ... available in horizontal models (deflectors optional) and in low-silhouette vertical models.

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For the Engineer
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APPLICATION
ESTIMATING
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Volume 58, Number 4 **April, 1961**

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COVER PHOTO: A self-contained air-conditioned suit which can keep the wearer comfortable in outside temperatures ranging from minus 40 to plus 135 deg F has been developed by scientists of Westinghouse Electric Corp. and the U.S. Naval Supply Research and Development Facility. **Utilizing a thermoelectric heating and cooling unit** which is fitted into the back, as shown at right, the climatic suit is made of an insulated aluminum-coated fabric. Only moving parts in entire system are two small fans which circulate and distribute conditioned air around the wearer. Battery pack, worn in front, powers suit for one hour, allowing this period of time away from any fixed power source.

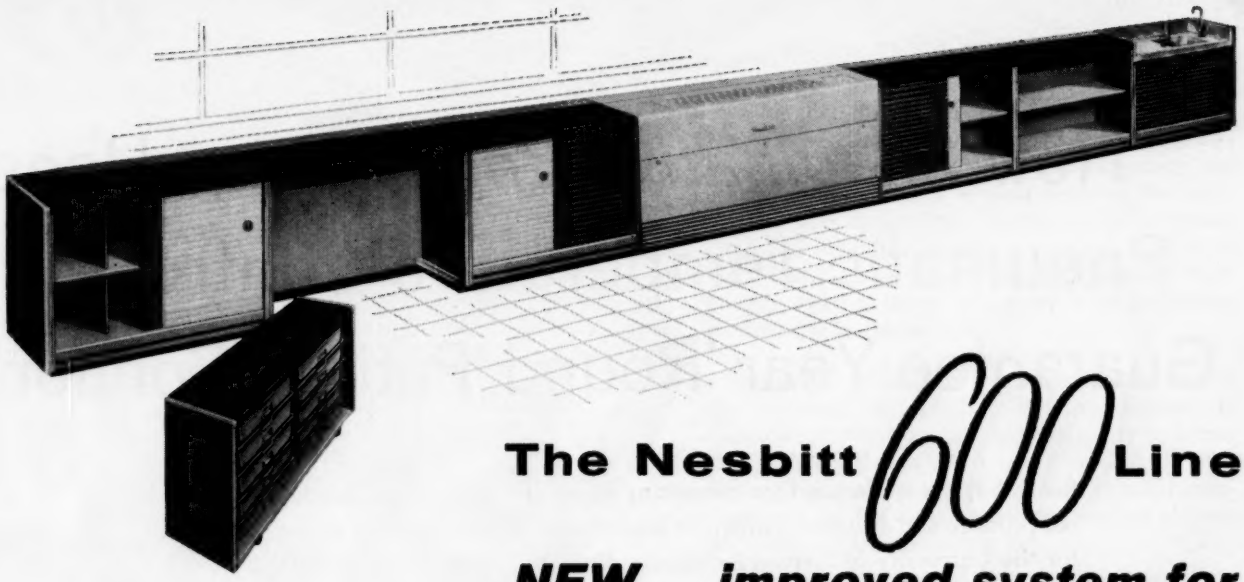
HIGH SPOTS in this issue

ASH HANDLING: This month's **Reference Section** is a wrap-up of the whole subject of **ash handling for commercial and industrial plants**, prepared by those who ought to know: the engineers with National Coal Association. Pneumatic, hydraulic, mechanical and special types of systems are covered. The subject is continued on the **Reference Data Sheet** with NCA-suggested specifications for ash handling equipment. Starts on page 71.

HEAT PUMP SYSTEMS: Central station heat pump systems having an air source are the subject of this month's lead-off article, beginning on page 57. Author Dick Japhet illustrates and describes four basic heat pump cycles, and evaluates them, for the designer, from an economic point of view. Small, packaged-type units are ignored, but a rather comprehensive look is taken at the **design and application of the larger, air source heat pump systems.**

U-VALUES CAN MISLEAD: The standard U-factor method for **computing heat transfer through building walls** leads to serious errors at corners, projections, where metal members pierce the wall, etc. Professor Komkov details some of the places that bear special treatment and suggests the order of magnitude of corrections that ought to be applied. See page 63.

HOW TO ESTIMATE COSTS: Part 1 in a series of interest to both **estimators for contractors and those who have to prepare a budget estimate in consulting offices** introduces the subject by explaining what the estimate is, who is qualified to prepare it, and how the data are collected. Author Robert J. Smith was a licensed plumbing and heating contractor for over ten years, now does mechanical estimating for a large firm of architects and engineers. Page 65.



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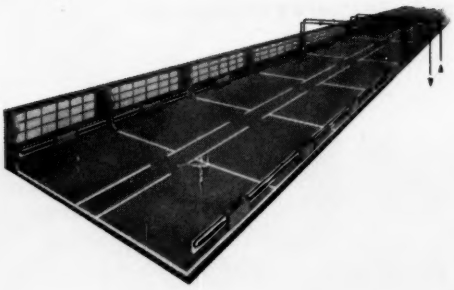

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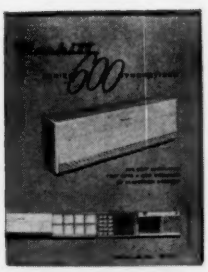

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Wind-o-line solves the cold downdraft problem . . . but more than that: In a forced hot water system the copper tubing of Wind-o-line finned radiation serves as the supply and return piping for the Syncretizer unit ventilators in a whole group of classrooms. Costly pipe trenches, conventional mains, run-outs and pipe coverings are eliminated.

Syncretizer multiple serpentine heating elements deliver the required heating capacity with water quantities a third or less of those demanded by conventional elements; and the additional heating surface provided by Wind-o-line further reduces the water quantity. Smaller pipes and pumps are used.

The gravity heating capacity of the Syncretizer with Wind-o-line radiation is more than sufficient to maintain adequate building temperatures during shutdown periods. Special controls and intermittent fan operation are unnecessary.

Thus, for daytime comfort, nighttime protection, and *reduced system costs*—WIND-O-LINE MAKES THE DIFFERENCE!

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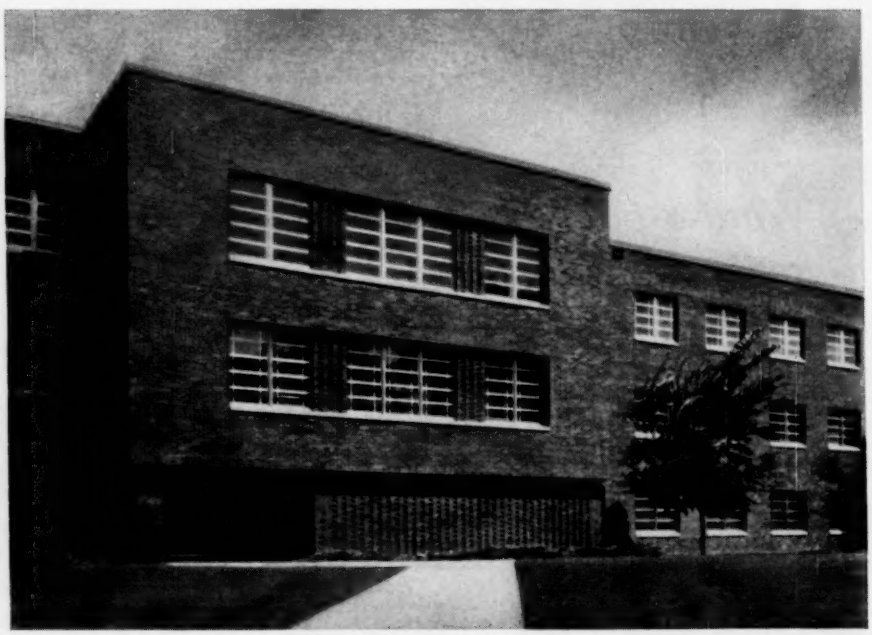
How *Imaginative Engineering* Uses Pneumatic Temperature Control To Guarantee Year 'Round Patient Comfort

Scott & Kinney, Kansas City consulting engineers, took a new look at an old problem and designed a *different* heating and air conditioning system for the University of Kansas Psychiatry Building. Their unusual method features two separate fan systems and a unique automatic damper application that eliminates the noise and distribution problems usually encountered with ordinary single-fan systems.

Providing uniform year 'round temperature together with foolproof individual room control has always been a problem in designing buildings of this nature. But Scott & Kinney provided the solution in their selection and imaginative arrangement of a Powers Pneumatic Control System.



Building "G", University of Kansas Medical Center

ARCHITECTS:
Kansas State Architectural Dept., Topeka, Kansas

CONSULTING ENGINEERS:
Scott & Kinney, Kansas City, Missouri

MECHANICAL CONTRACTOR:
A. D. Jacobson Plumbing & Heating, Inc., Kansas City, Missouri

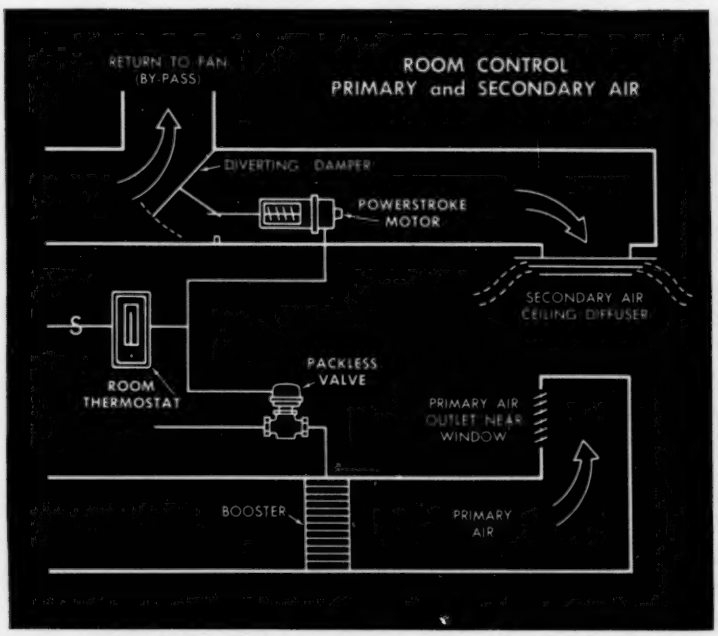
Final check on the U. of K. Psychiatry Building's pneumatic control system by the consulting engineers, Wilson O. Kinney (left) and Arthur R. Scott.

Heating, ventilating and air conditioning are accomplished through primary and secondary air systems. The primary system operates throughout the year, supplying a small amount of circulated air, including outside air. Final control in the primary system is a reheat coil — one for each patient room — using hot water with a Powers modulating packless valve.

Heart of the secondary — or booster — system is the automatic, quick-acting diverting damper. It permits both fresh and refrigerated air to pass into the individual rooms through a ceiling diffuser. When cooled air is not needed, it is diverted automatically by the damper into the ceiling plenum for return to the secondary fan.

To simplify individual room control of temperature, Scott & Kinney coordinated the actions of the reheat coil and the auto damper into a single control. One thermostat in each room controls both for maximum comfort.

This imaginative handling of standard Powers temperature control equipment is another example of problem-solving by the consulting engineer and the specialized help of Powers field engineers. The University of Kansas has reaped the benefits for the last four years — in comfort, operating economy and low cost maintenance.



For more ideas and technical data on Powers pneumatic temperature control equipment and systems, write for the latest Powers Catalog.

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What Readers Say:

Commercial Kitchen Ventilation

EDITOR,
AIR CONDITIONING, HEATING AND VENTILATING

We have noted with interest the "Hood with Grease Filters" detail sheet that you have in your January, 1961, issue. As one who does a lot of this kitchen ventilation work with commercial dealers in this area, we would like to point out, however, that there are some things about the design that you show that are not at all desirable and, as a matter of fact, would not even meet the codes in Maryland.

In the first place, grease gutters are "taboo" with local sanitarians for the reason that they are a source of extreme contamination which are never serviced by operators.

Secondly, filters are never put in horizontally as shown on the double wall type hood on the rear page, and even the manufacturers of the filters object to this strenuously, for the simple reason that once the filters get dirty they begin dripping downward; under no circumstances should they be put in unless on a 45 degree angle.

The third objection is that the way the filters are located in the upper back part of the hood (refer to open type hood placed at inner wall), there is not enough room for the air to pass laterally behind the filters, and they should never be located up in the rear corner of the hood as shown. You would simply not be able to spread the air out across the filter bank if you connected your duct work in this manner, but the writer feels the filters should be dropped down so that the bottom support is at the lower edge of the hood; then you will have a plenum chamber above the filters permitting the air passage laterally.

As we have pointed out above, the Department of Health in Maryland and all of the county sanitarians would most certainly reject any hood that was designed in this manner.

Edwin H. Taze

Taze and Hewitt, Inc.
Sales Engineers
Baltimore, Md.

In recognition of the points raised by Mr. Taze, the editors have had a new detail sheet prepared on the subject of exhaust hoods for commercial kitchen ventilation. It appears this month and should supersede the detail sheet of January, 1961.

Reciprocating Water Chillers

EDITOR,
AIR CONDITIONING, HEATING AND VENTILATING

I read with interest the comprehensive article by Richard Stamm about capacity control of reciprocating water chillers in the November and December, 1960, issues of your magazine.

Figure 10 of the article (December) illustrates the relationship between the suction temperature and the water temperature is a system which uses compressor capacity control actuated by the decreasing suction pressure.

As presented in the illustration, the suction temperature decreases uninterruptedly and no apparent change in the suction temperature (and pressure) takes place when any of the cylinders are unloaded.

My question is that since the unloading of the cylinders causes an appreciable decrease in the pumping capacity of the compressor, will not the points of unloading be accompanied by a certain abrupt rise of the suction temperature (and pressure)?

As the cooling capacity of the system is directly proportional to the difference between the mean water temperature and the suction temperature, due to the lack of any considerable change in the suction temperature at the points of unloading, the cooling capacity of the system would not decrease in a sufficient amount.

I may have neglected some factors which bring about this behavior of the system as illustrated in Fig. 10 of the quoted article, and I would certainly appreciate some further information about the details of this interesting problem. Thank you.

Nicholas Holbay

Mechanical Engineer
Department of Physical Plant
Purdue University
Lafayette, Ind.

A copy of the letter written by Mr. Holbay was sent to Mr. Stamm for his comments. The author's reply follows:

EDITOR,
AIR CONDITIONING, HEATING AND VENTILATING

Mr. Holbay is correct in that the suction pressure would not diminish in a straight line as we have it shown in Fig. 10. The suction temperature shown is a mean suction temperature. This is done as it is impossible to show time in a curve such as this as we get more variables than we have space. Essentially what happens, when unloading on suction pressure, is that any condition except full load the cylinder unloaders cycle. As the system load starts dropping below full load, the compressor cycling would dip to its 75% depth, stay there momentarily, and then load

(Continued on page 10)

NEW NEW NEW

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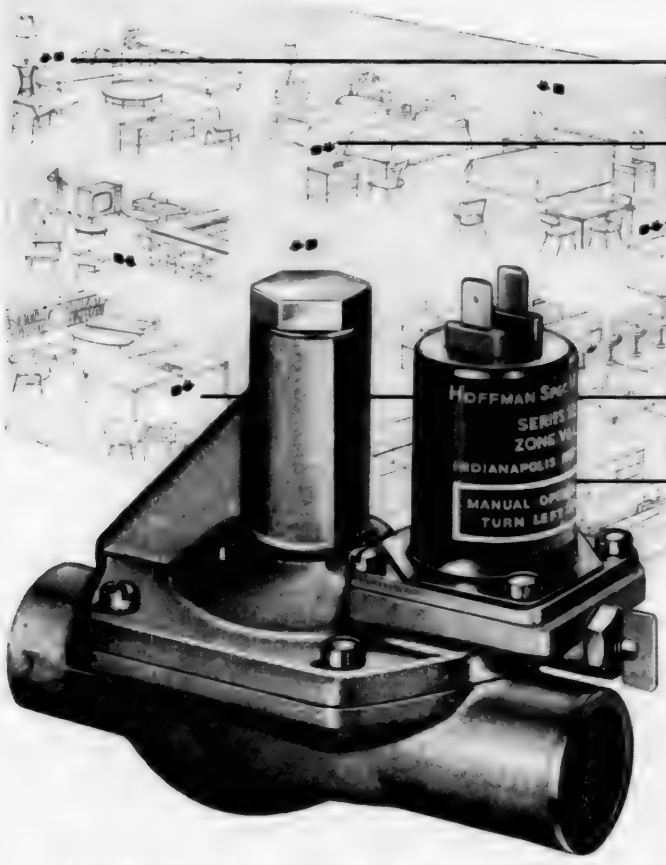

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temperature

to occupant

in each zone

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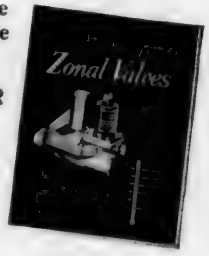
With Hoffman Zonal Valves, temperature can be precisely and individually controlled in each living, working, or playing zone . . . in small 2-zoned residences as well as large multi-zoned structures. Designed for use on modern 2-pipe hydronic heating and cooling systems, Hoffman Zonal Valves are compact in size (only 2⅝" wide for small-area installations), operate noiselessly (can be installed in bedrooms), and close completely (there's no leak-through to waste fuel). *Free*, fact-filled literature detailing information on these diaphragm-type Zonal Valves and zone control system components is available from your wholesaler or Hoffman.



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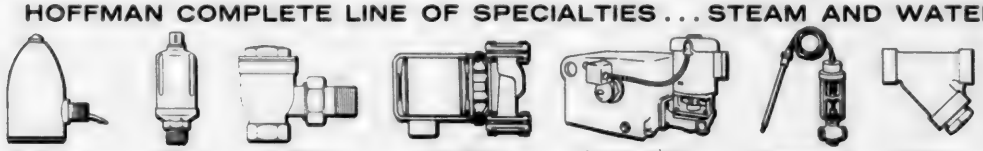

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What Readers Say:

(Continued from page 8)

up again in order to give a mean suction temperature such as we have shown on the graph. As the system load approaches 75%, the compressor will stay on the 75% step and load up to 100% just momentarily.

Due to the time lag, the chilled water temperature doesn't vary appreciably but tends to average out.

Richard H. Stamm

Assistant Manager
Reciprocating Compressor Dept.
The Trane Company
La Crosse, Wis.

Economic Application of Insulation

EDITOR,
AIR CONDITIONING, HEATING AND VENTILATING

Mr. Thomas' suggested procedure for determining the proper amount of insulation of a structure is very timely and most enlightening.

The author rightfully observes that in some cases, due to "the indefensible practice of assuming insulation thickness," excessive quantities of insulation may be used which might be difficult to justify, while in other instances insufficient amounts may be causing excessive heating cost. Unfortunately, similar and perhaps more serious results will materialize by restricting the economical evaluation to the heat transmission through the walls, floor, ceiling, or roof of the structure, and excluding: (1) the ventilation or infiltration heat requirements, (2) the heat transmission through the windows and doors, and (3) the effect of the usable heat gain in the space, particularly for commercial and industrial buildings.

The importance of all of these influencing factors, in an economical study, can perhaps best be demonstrated by comparing the heat loss of the components as a percentage of the total for the structure. In an uninsulated structure, for instance, the walls, floor and ceiling can represent as much as 50 to 70 percent of the total loss, and the ventilating and heat transmission through doors and windows the remaining 30 to 50 percent. With a reasonable amount of thermal insulation, however, this relationship will change and the heat loss through the solid exterior surfaces may be reduced to approximately 35 percent of the total, while the storm windows, double doors and infiltration will account for the remaining 65 percent. Consequently, since the largest percentage is now caused by the windows and ventilation air, it will probably be more profitable to reduce these losses instead of adding more insulation to the walls. In addition, consideration should be given to the internal heat gain from the lights, appliances, occupants, and solar radiation which may offset the gross heat loss of the structure by 25 to 30 percent, or even more.

Because of the diminishing return of the additional insulation, the question seems to be at what point, when taking the internal heat gain into consideration, will it be more economical to reduce the heat loss through the windows and doors with perhaps a corresponding reduction in the infiltration air, instead of further increasing the thermal efficiency of the insulated ceilings, walls or floors.

It is realized that the author only included the three examples to illustrate the recommended procedure. Nevertheless, it should be pointed out that degree days (D), given in Table 1, are probably based on a 65F base which means that the indoor temperature is maintained at 70F. Consequently, these degree days cannot be correctly used with either the 66F or 72F indoor temperature given in the example. It is also questionable whether the 70 percent overall seasonal efficiency, used in the example for a fuel fired system, can be substantiated. On the other hand, using formula (7) to predict the annual heat loss of an electrically heated residential structure will give a value considerably in excess of the actual requirements. It is for this reason that the electric utilities, based on tests of a number of electrically heated, insulated houses, recommend using the formula $F = \frac{H \times (DD) \times C}{(TD)}$ in order to obtain realistic annual opertaing cost. In this formula, F = annual heating kwh, H is design heat loss in kw, (DD) is degree days with 65F base, C is a constant, and (TD) is the indoor-outdoor design temperature difference. A constant C of around 18 is frequently used but has been found to vary considerably due to the differences in annual weather conditions, geographic location, design and orientation of the house, living habits, etc.

E. R. Ambrose

Head-Air Conditioning Division
American Electric Power Service Corporation
New York, N. Y.

Changes in Coil Hookup

EDITOR,
AIR CONDITIONING, HEATING AND VENTILATING

Steam coil connections generate differences of opinion. I believe some changes would improve the detail sheet on steam heated coils in your February, 1961, issue. The suggestions follow:

1. Pitch of the coils to drain should be given as some minimum per foot of length, as $\frac{3}{16}$ inch or so.
2. The coils should be individually trapped.
3. The thermostatic bypasses are of doubtful value on coils fed by *modulating* control valves. The float and thermostatic trap should be able to vent the coil rapidly enough.

(Continued on page 150)

The O'Keefe Centre
for the Performing Arts

TORONTO, ONTARIO

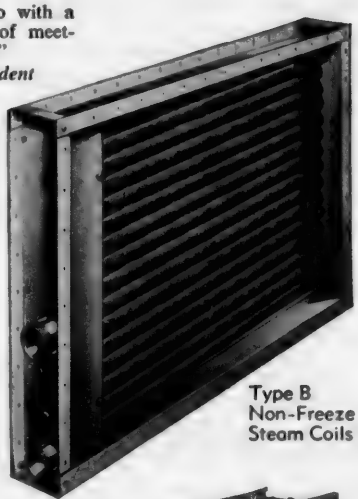
Architects: Earle C. Morgan and Page & Steele, Toronto
Mechanical Engineers: Forst, Granek & Associates, Toronto
General Contractor: Anglin-Norcross, Ontario, Ltd.
Mechanical Contractor: Universal Plumbing & Heating Co.

New 3200-seat theatre will "provide Toronto with a multi-purpose entertainment centre capable of meeting all tastes with the best facilities available."
T. E. Arkell, President

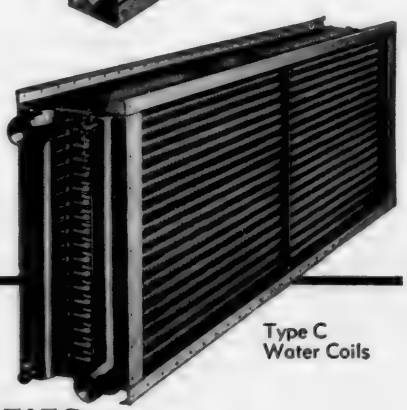
AEROFIN INSTALLED

Modern smooth-fin design of Aerofin coils permits ample heat-exchange capacity in limited space — permits the use of high air velocities without turbulence or excessive resistance.

Aerofin performance data are laboratory and field proved. You can safely specify Aerofin coils at full published ratings.



Type B
Non-Freeze
Steam Coils



Type C
Water Coils

AEROFIN CORPORATION

101 Greenway Ave., Syracuse 3, N.Y.

Aerofin is sold only by manufacturers of fan system apparatus. List on request.

ENGINEERING OFFICES IN PRINCIPAL CITIES

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NEWS OF THE MONTH

Pros and Cons of District Heating-Cooling Outlined by Consultant in Hartford Project

When is district heating and cooling economically advantageous? There is no simple rule, says Erik B. J. Roos, partner, Seelye, Stevenson, Value and Knecht, New York, consulting engineers. (The firm made the engineering studies for Hartford Gas Company's new power plant that will supply steam and chilled water to Constitution Plaza, a complex of new buildings in downtown Hartford, Conn. See "First Utility-Operated Central Plant to Heat and Cool Hartford Office Buildings," Air Conditioning, Heating and Ventilating, October, 1960, page 8.)

The pros and cons of a district scheme must be considered in a separate economic evaluation for each project, Mr. Roos said. Advantages to be weighed include:

Advantages Outlined

(1) Larger units cost less per pound of steam or ton of refrigeration. (2) Larger units need less space than a number of smaller units of the same output. A building housing a central plant does not require as expensive construction as would the same space for the same purpose in a hotel or office building. (3) Within the limits imposed by the cost of distribution, a central plant may be located on the least costly real estate.

(4) Larger machines permit greater refinement in design, construction, instrumentation and control. This results in more efficient operation.

(5) A central plant will have less duplication of auxiliaries, such as fuel pumps and water treatment. (6) While a separately heated office building should have at least two boilers, one as standby, for a central plant with five units, a spare would mean less than 20% in additional cost.

(7) In a central plant at partial load (a situation that exists most of the time) only enough units are used, each operating near its point of maximum efficiency, to meet this load. (8) A large central plant can usually purchase its fuel and power at lower cost. (9) A central plant requires much fewer personnel and these men have no other function than to look after their equipment. Better qualified personnel are needed and can be justified.

Disadvantages

The disadvantages are:

(1) External distribution must be run underground, which is more costly than running pipe around inside a building. (2) Underground piping must be protected against corrosion, electrolytic action, and vibration from traffic. When the water table is high, this protection becomes more expensive and there is a maintenance problem. (3) Since piping is usually run in streets the cost of laying new pipe in an already crowded street may be prohibitive. (4) Long lengths of piping may entail excessive heat loss or gain.

Mr. Roos states that, as to the positioning of the hot and cold lines in a trench, the two lines are set as far apart as possible to prevent heat transfer between the two. Although placement side by side is preferred, sometimes because of street conditions, one line is placed above the other.

Chilled water lines may be buried without insulation when ground temperature is close to that of the chilled water supply. Chilled water supplied to the Hartford buildings is 42 to 45 deg; return temperature is 55 to 60 deg. Integrating meters will measure both flow and temperature difference. This makes it possible to bill the customer on a Btu basis for heating and cooling.

COUNTLESS BROCHURES and a mass of material from hundreds of suppliers shown above at left have been condensed into a 10-volume Maintenance Manual for the new Indiana State Office Building in Indianapolis, Ind. It took months of research by Architect Raymond S. Kastendieck of Gary, Indiana, seated, and the Chicago firm of Graham, Anderson, Probst & White, whose president Marvin Probst, is shown at left. At rear is photo-mural of building.

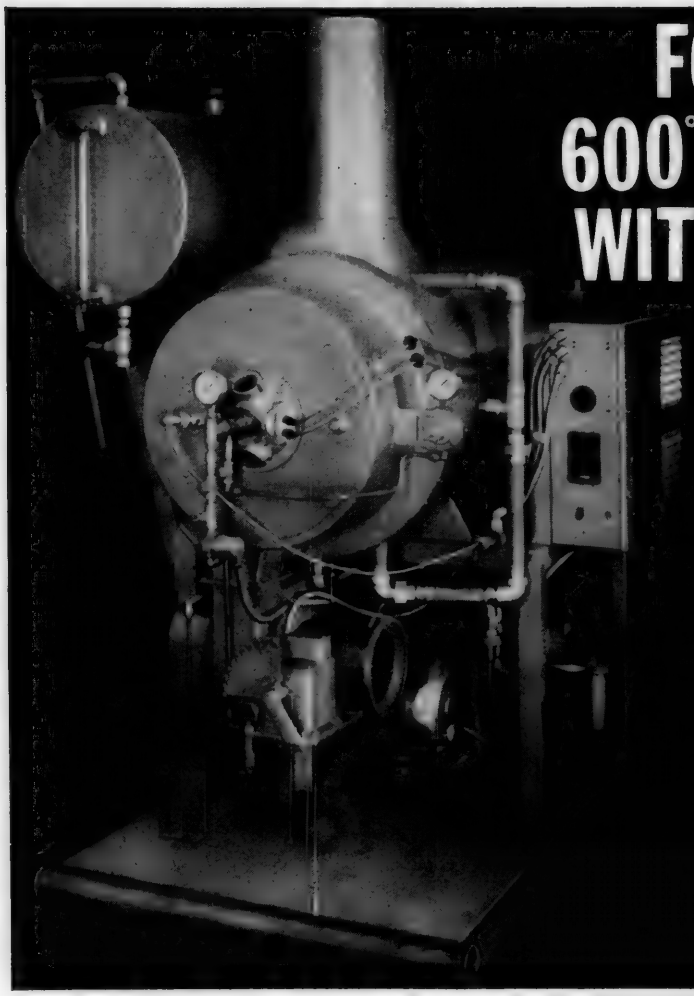
REVISED SAFETY STANDARDS READY FOR NFPA ADOPTION

More than 65 new and revised fire safety standards affecting a wide range of industrial and commercial interests will be up for action at the National Fire Protection Association's forthcoming annual meeting which opens May 15 at the Statler Hilton Hotel in Detroit.

The text of the proposed new standards and revisions of existing ones will be printed in the NFPA 1961 Advance Reports, a single volume of approximately 1,000 pages. Distributed free to NFPA members, the volume is available at $3.50 per copy from the National Fire Protection Association, 60 Batterymarch Street Boston 10, Mass.

In line with NFPA democratic procedures any interested party,

(Continued on page 138)



FOR 600° TEMPERATURES WITHOUT ANY PRESSURE!

VAPOR MODULĀTIC

HI·R·TEMP

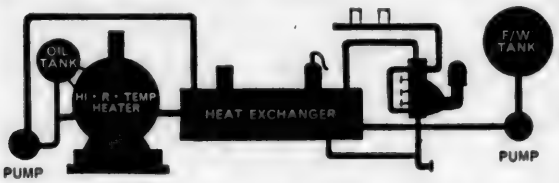
LIQUID PHASE HEATER

This Vapor Modulātic HI·R·TEMP Liquid Phase Heater uses heat transfer aids to provide dependable, automatic, accurately controlled heat transfer to 600° F., without high pressures. Burns natural gas, propane, butane, No. 2 diesel oil, or kerosene. Sizes to 13,000,000 b.t.u.

Check these advantages:

- ACCURATE TEMPERATURE CONTROL. Modulāting controls automatically maintain pre-determined temperature of heat transfer oil.
- NO WATER TREATMENT NEEDED. Eliminates cost of treatment system. No corrosion, scale, freezing problems.
- POSITIVE OIL FLOW. Rotary gear pump assures uniform circulation...prevents hot-spots, coking, sludging, oil breakdown.
- LOW INSTALLATION COST. Completely unitized, skid-mounted with all piping in place. Factory tested before shipment. Compact, lightweight...install it anywhere.
- LOW-PRESSURE VESSELS AND FLOW CIRCUITS. Saves the cost of heavy-duty piping, fittings, valves.
- COLD OIL SEAL. Expansion tank is uninsulated and isolated from main flow of hot transfer oil. Protects oil against atmosphere, sludging, deterioration.
- OPTIMUM SAFETY. Non-toxic. Built to ASME codes. Flame failure, low oil level, high temperature safety shut-off controls are standard. CO_2 quenching ring optional.
- LOW OPERATING COST. Forced-draft combustion, coiled tube design is highly efficient. No high pressures, does not require licensed engineer to operate.

here's how one vapor Hi·R·Temp, with heat exchangers, can supply your needs for processing, heating, hot water, etc.



Heated oil from HI · R · TEMP (at temperatures to 600° F.) passes through heat exchangers to provide steam for processing; at 450° for steam for heating plant and office; at 200° for hot water for cleaning, washing, other uses. Provides full, economical use of heat to lower your operating costs!

VAPOR

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80 East Jackson Boulevard, Chicago 4

Please send me Bulletin 4023 on your HI·R·TEMP Liquid Phase Heater.

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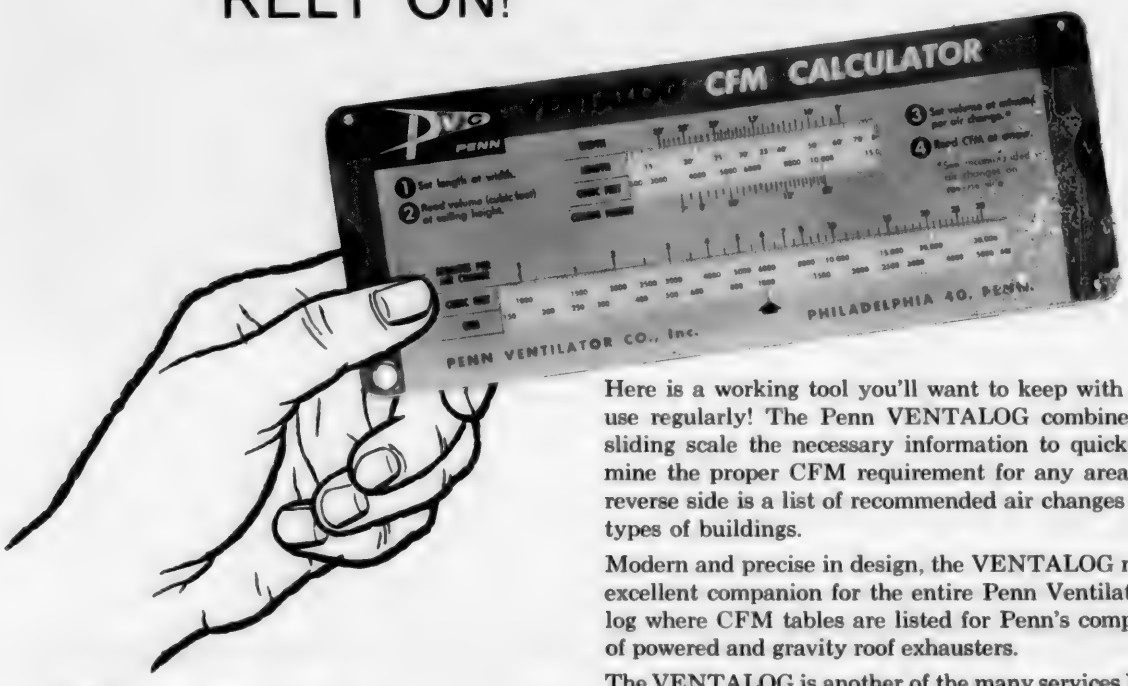
PENN VENTILATOR **FIRST IN PROGRESS** WITH A NEW AID ENGINEERS CAN RELY ON!

NEW

VENTALOG CFM CALCULATOR

helps you determine necessary CFM right on the spot!



Here is a working tool you'll want to keep with you and use regularly! The Penn VENTALOG combines in one sliding scale the necessary information to quickly determine the proper CFM requirement for any area. On the reverse side is a list of recommended air changes for most types of buildings.

Modern and precise in design, the VENTALOG makes an excellent companion for the entire Penn Ventilator Catalog where CFM tables are listed for Penn's complete line of powered and gravity roof exhausters.

The VENTALOG is another of the many services Penn has provided for Specifying Engineers and Architects to aid them in their complex task of producing the best in buildings . . the most efficient way! Contact your local Penn Representative for your free VENTALOG, or write direct.

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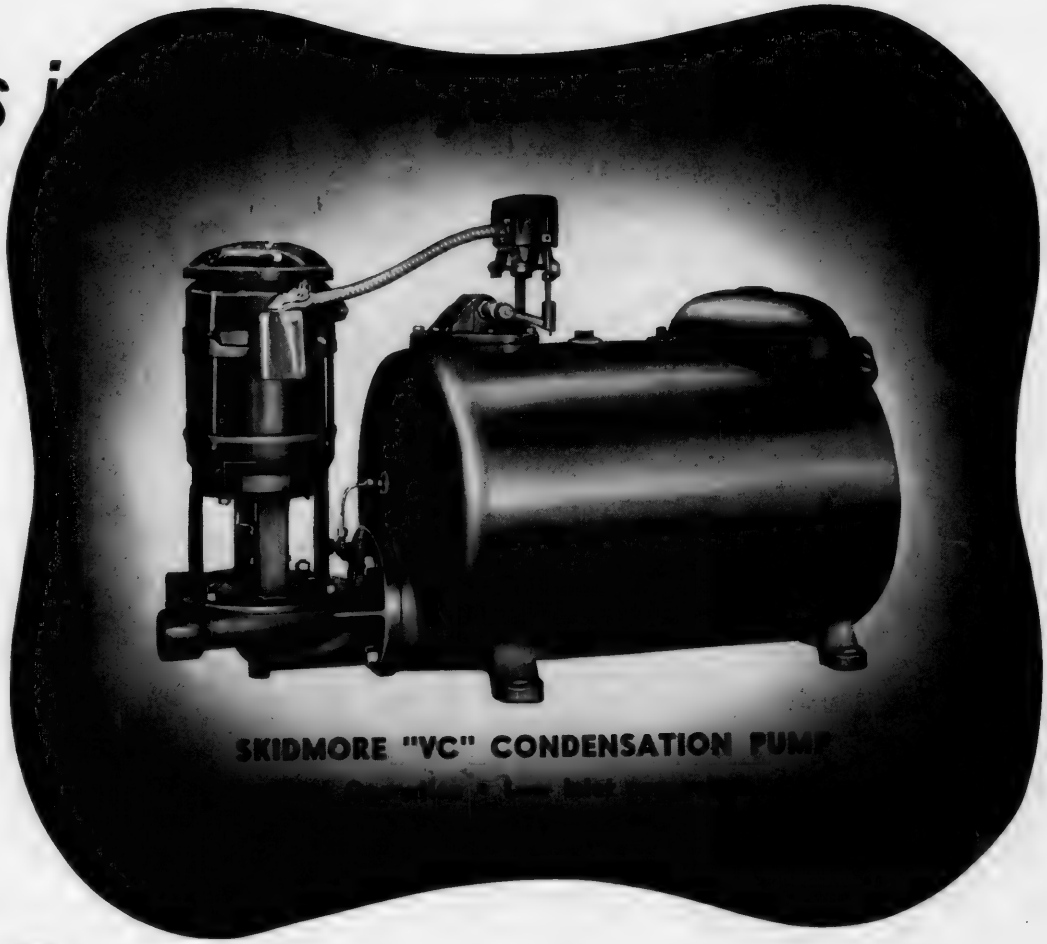
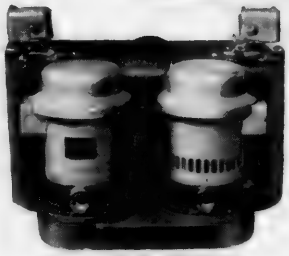
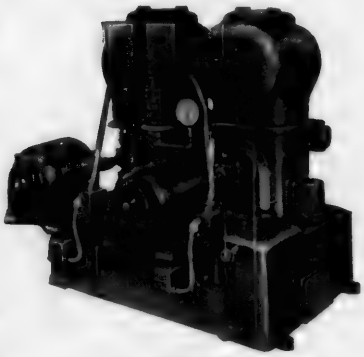


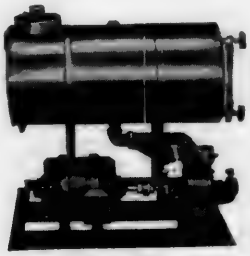


TYPE CCVS—DUPLEX
Bulletin No. 21-C

You can meet your exacting needs in heating pumps with Skidmore. For quiet, dependable operation, a Skidmore Pump combines the latest features in centrifugal pump design with a minimum of space requirements and a wide range of selectivity. Designed to return condensate to the boiler or other points . . . pump unit operates **free** of any close-clearances, assuring longer operational periods without cost for service or maintenance.



VACUUM PUMP
Bulletin No. 9-B



TYPE TM
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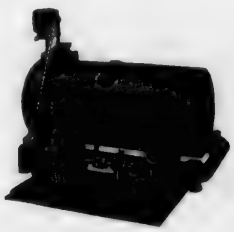

TYPE HS
Bulletin No. 14-B

SKIDMORE CORPORATION, ST. JOSEPH, MICHIGAN

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Mr. George Stewart, mechanical contractor for
Jane Addams Elementary School, Melrose Park, Illinois, says:

"Honeywell stayed on to Jane Addams job to our

Mr. George Stewart, in the equipment room at Jane Addams Elementary School. The Honeywell panel behind him enables the building engineer to check the entire pneumatic control system.

check out the complete satisfaction"

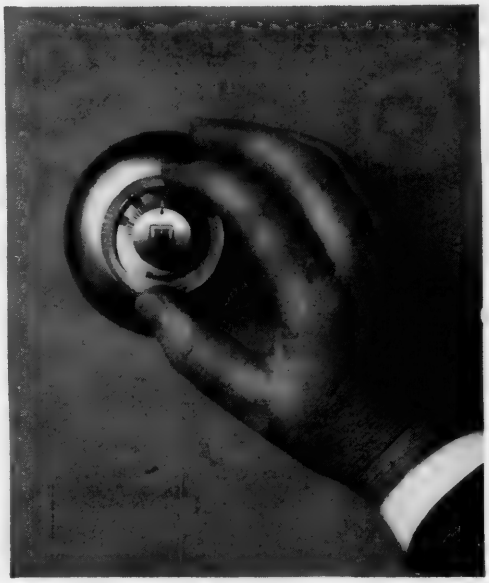
JANE ADDAMS ELEMENTARY SCHOOL
Architect-Engineer: Kefer & Cronin, Chicago
Mechanical Engineer: Albert W. Marshall, Chicago
General Contractor: Louis Macro Co., Melrose Park, Illinois
Mechanical Contractor: Tropf Heating Co., Broadview, Illinois

At Jane Addams Elementary School, Honeywell servicemen stayed on the job long after the building was completed to make sure the temperature control installation operated perfectly

"Honeywell really came through for us on the Jane Addams job," says Mr. Stewart. "They saw that the temperature control equipment was delivered on time and installed on time. They turned in clear shop drawings of the temperature control system. They gave us good supervision during installation, then stayed on to thoroughly check out the system to make sure it worked well under actual school conditions."

At Jane Addams Elementary School, Honeywell installed Pneumatic Round thermostats on the wall of every classroom. On the wall, they feel temperature in the classrooms the way students do. And they are also more convenient to read and adjust to offset varying effects of weather, occupancy and student activities.

You can depend on Honeywell to help you do a quality job. Fine controls, accurate specifications, prompt delivery and supervised installations are assured with Honeywell on your team. And only Honeywell gives you a choice of all three types of control systems—pneumatic, electric and electronic. For further information, call your nearby Honeywell office. Or write Honeywell, Dept. HV-4-32, Minneapolis 8, Minnesota. *Sales and Service offices in all principal cities of the world.*



This is the Honeywell Round, the world's most popular thermostat. It enables teachers to adjust temperatures to fit specific learning activities.

Honeywell

First in Control

SINCE 1885

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New Anemostat Architectural Straight Line Diffusers at Cornell University

Here is the new Anemostat ASL Architectural Straight Line Air Diffuser installed in the Willard Straight Hall of Cornell University at Ithaca, New York. This new ASL unit for ceiling or wall application combines the superior air diffusion characteristics of all Anemostat air diffusers with the esthetic appearance of a slender unit with symmetrical vanes. The ASL diffusers are easy to install; no screws, nuts or bolts are needed.

Write for Anemostat Catalog ASL-70

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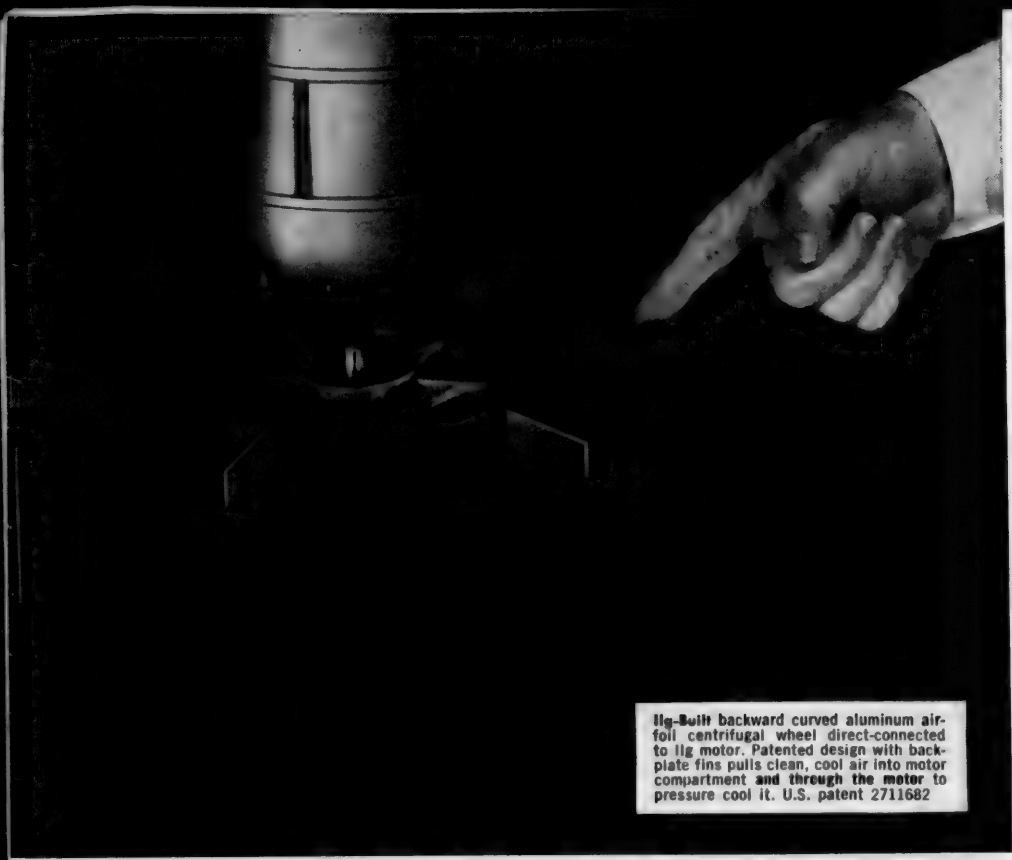
If there is ever a better flush valve...its name will be

SLOAN

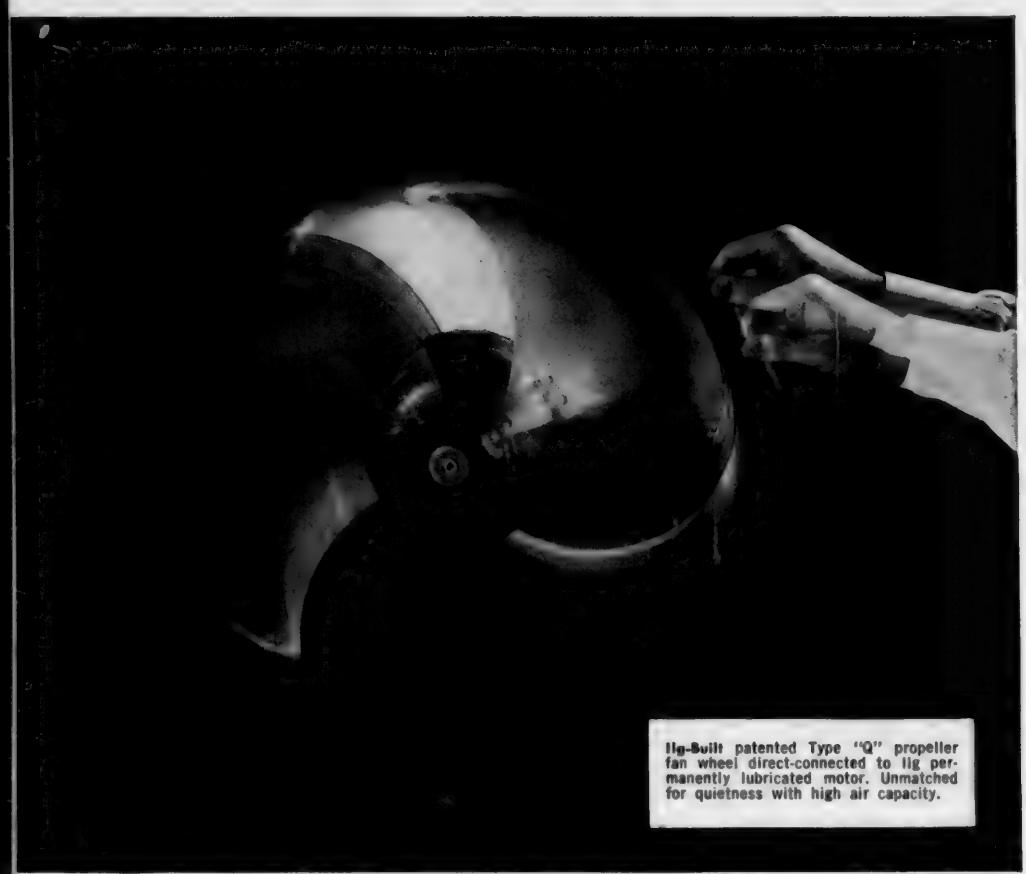
Continuing research by SLOAN for more than 50 years has made the ROYAL Flush Valve the standard by which all other flush valves are judged. Product improvements—such as no regulation, non-hold-open, inside cover, segmented rubber diaphragm, parts of Du Pont Delrin®—are made only after years of thorough field testing. Thus, long lasting, low maintenance performance is the result of excellence in engineering and research. This is the bonus of quality you expect, and receive, from SLOAN.

SLOAN FLUSH VALVES

SLOAN VALVE COMPANY • 4300 WEST LAKE STREET • CHICAGO 24, ILLINOIS



Ilg-Built backward curved aluminum airfoil centrifugal wheel direct-connected to Ilg motor. Patented design with backplate fins pulls clean, cool air into motor compartment **and through the motor** to pressure cool it. U.S. patent 2711682



Ilg-Built patented Type "Q" propeller fan wheel direct-connected to Ilg permanently lubricated motor. Unmatched for quietness with high air capacity.

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BE RIGHT . . . WRITE IN

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Ilg L-CRF Power Roof Ventilator with patented pressure-cooled motor protected against build-up of heat from sun . . . *increases motor life expectancy up to four times that of ordinary units.* Fifteen sizes to choose from for capacities from 155 to 27,290 cfm. WRITE FOR CATALOG DB3-200.

Ilg PRV Power Roof Ventilator. (1) Leakproof roof hinged on two sides for speedy inspection. (2) Direct-connected, self-cooled, permanent-split capacitor, single-phase or 3-phase motor. (3) Air shield keeps lint, grease, fumes and dust from motor. (4) Rainproof baffles with heavy steel mesh protect against entry of birds and animals. (5) Backward centrifugal fan wheel blades can't overload motor. WRITE FOR CATALOG DB3-400.

Look first to Ilg for power roof ventilators and you save a lot of looking. Four housing designs to choose from; two fan types, either propeller blade or airfoil blade centrifugals.

Regardless of which direct-connected Ilg roof ventilator you choose, you're sure of performance as maintenance-free as a fan can be. Careful dynamic balancing of all component parts . . . plus electronic checks of Ilg-built motors and Ilg patented Type "Q" propeller fan and centrifugal fan wheels . . . makes sure that smooth, vibration-free operation is as much a part of each ventilator as the Ilg "One-Name-Plate" pledge of performance.

Ilg L-LSQ Power Roof Ventilators feature direct connected, patented "Q" fan wheels that pass air over blade smoothly, quietly. Low starting torque of Ilg 3-phase and permanent-split capacitor, single-phase motors eliminates starting shock, lengthens fan life. Eleven sizes to choose from for capacities from 287 to 21,100 cfm. WRITE FOR CATALOG DB3-100.

Ilg UB Power Roof Ventilators with butterfly dampers are ideal for high-speed, vertical exhaust for industrial and commercial applications. Airfoil-design propeller blades are direct-connected to Ilg-built totally enclosed motors. Five sizes to choose from for capacities from 5060 to 33,300 cfm. WRITE FOR CATALOG DB3-300.

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Each Ilg product shown carries the rating seal of the Air Moving and Conditioning Association, Inc.

WAGNER® MOTORS AT WORK

power to cool a clerical center

Two Wagner® 900 hp motors utilize easily accessible low voltage power to drive centrifugal compressors in New York's Interchurch Center

One of the newest office buildings in the city, the 19-story Interchurch Center houses more than 2,000 workers. It is completely air conditioned . . . all 400,000 square feet of it.

It's a big job, powering the centrifugal compressors in a system that is designed to air condition that much space. A job usually handled by high voltage motors, but done here by two 900 hp Wagner® Type RP open type motors rated at 460 volts, 1750 RPM. They were specified to take advantage of an easily accessible low voltage power supply, and so eliminate the expense of running in a high voltage line. How do they perform under loads created by centrifugal compressors? Simply put, they operate at peak efficiency, day in and day out.

Compact and dripproof, Wagner RP motors are packed with power and stamina. They're the perfect drives for big pumps, fans, and blowers as well as compressors. Built in frame sizes 504U through 962S, Wagner open type motors are available in ratings through 1000 horsepower.

Want your motor application analyzed? Call your Wagner Sales Engineer. His recommendations, and Wagner motors, will serve you well.

THE INTERCHURCH CENTER

Owner: The Interchurch Center

Architects:
Collens, Willis and Beckonert
Vorhees Walker Smith Smith & Haines

General Contractor:
Turner Construction Company

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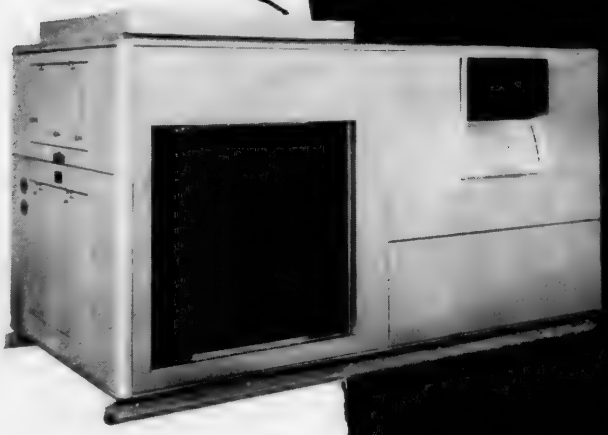
Governair

COMPLETELY SELF-CONTAINED

AIR COOLED

PACKAGE UNIT TYPE SCAC



GOVERNAIR'S SCAC is available in six basic models from 10 through 40 ton capacities. Typical GOVERNAIR flexibility has been maintained with a choice of 4, 5, or 6 row cooling coils offered to meet all capacity requirements. Roof mounting has been considered in the Low-Silhouette arrangement.

The basic one-piece cooling unit is housed in a rugged weatherized cabinet and mounted on rails. It is completely wired, charged and tested at the factory. Demountable and remote arrangements are available, and accessories include choice of filters, face and by-pass dampers, reduced voltage starters, Low Ambient Control, and the Gas Fired Furnace Section.

YEAR-'ROUND AIR CONDITIONING is accomplished by the use of the gas-fired furnace section. This accessory consists of a complete and unaltered gas-fired duct furnace housed in a Weatherized Cabinet with an integral by-pass damper arrangement. Refrigerated air may completely by-pass the furnace, while any desired amount of air is diverted through the furnace during the heating cycle.

FOR AN INFORMATIVE FOLDER, CONTACT YOUR LOCAL GOVERNAIR REPRESENTATIVE OR WRITE

GOVERNAIR

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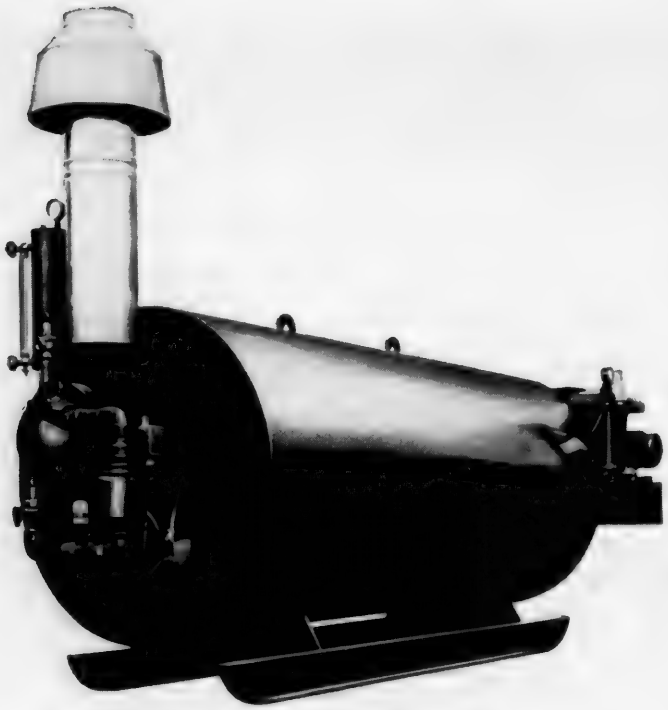


p-k scalefree 230*

first indirect gas fired storage water heater

provides lots of hot water...fast

for Hitchins, Ky., General Refractories Co. Plant

GENERAL REFRACTORIES COMPANY

A million-dollar expansion at the Hitchins, Ky., plant of the General Refractories Co. required a 40% increase in employees – and more hot water.

Following a survey of available heaters, the company decided on the SCALEFREE 230 because of its exclusive thermal design principle. The new heater employs three basic systems: the gas-burning system – the furnace part of the unit; a forced circulation transfer fluid system; and the service water system, which provides for storage, heating and temperature control. Since heat transfer occurs below the temperature at which the minerals that cause scaling precipitate, the unit retains its initial rated efficiency.

easily installed A complete and automatic package, the SCALEFREE 230 was installed by the maintenance crew at the plant in 16 manhours. Only inlet and outlet piping and simple electrical connections were required for the installation. The heater can be operated with any type of industrial gas – manufactured or natural.

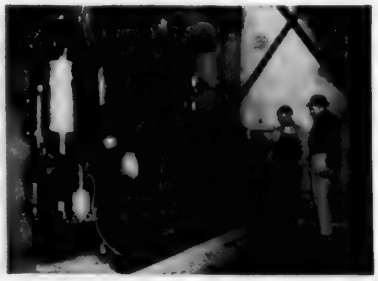
pre-krete®-lined General Refractories has assured itself of rust-free service water by specifying that the tank interior be lined with PRE-KRETE – a cement-base, plasticized material of high corrosion resistance. "It's just the thing for us," states the Plant Superintendent, "our water here in Carter County is full of minerals."

p-k scalefree 230 is available in plain steel or with linings of Pre-Krete or copper. Factory insulation optional. Storage capacities from 250 to 4,000 gallons; recovery sections from 390,000 to 2,215,000 BTU.

*Patent pending

Patterson Kelley

Water Heater Division, East Stroudsburg, Penna.



Installation of the SCALEFREE 230 took maintenance crew at General Refractories only 16 manhours.

For complete engineering and performance data SEND FOR P-K BULLETIN NO. 4

For more data circle this page number on card at back of book

Problem: Cold drafts and hot spots

This plant needs make-up air! If some workers in your plant shiver while others sweat, don't blame your heating system. Your exhaust system may be removing air faster than you replace it. This sets up a vacuum that can knock your entire heating system out of balance. Your plant needs make-up air...a supply of new air to replace exhausted air.

Without make-up air, the vacuum pulls in cold drafts along outside walls. Your heating system is overworked trying to offset the cold drafts. Hot spots build up at inside areas. Workers catch cold, or wilt from heat. Absenteeism rises.

Solution: install a make-up air system -- fans to bring in outside air, and heaters to temper it. The heaters in this make-up air system reduce the load on your regular heating plant, so there's no extra operating expense.

For technical help on make-up air, see your Consulting Engineer. Or call in Sturtevant application engineers. They're experts in handling air...whether you want to move it, heat, cool or clean it. J-00712

WESTINGHOUSE ELECTRIC CORPORATION
Sturtevant Division, Dept. DV12
Hyde Park 36, Mass.

Send me your make-up air booklet: ARE YOU "EXHAUSTING" YOUR PLANT PROFITS?

NAME_____

TITLE_____

COMPANY_____

ADDRESS_____

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You can be sure...if it's **Westinghouse**

SPORLAN THERMOSTATIC EXPANSION VALVES and REFRIGERANT DISTRIBUTORS

are the **PERFECT PAIR**
for **PEAK PERFORMANCE**

. . . they're
designed
to fit each other
for
smoother performance

Sporlan
Thermostatic Expansion Valves have proved to be the leader in the refrigeration and air conditioning field . . . and Sporlan alone offers you the tremendous advantages of the distributor with the Versatile Interchangeable Nozzle. It too has been the leader for many years.

No wonder then, that together they make the perfect pair for any installation.

Available in any combination of circuits and capacities, in flare, solder or flange connections.

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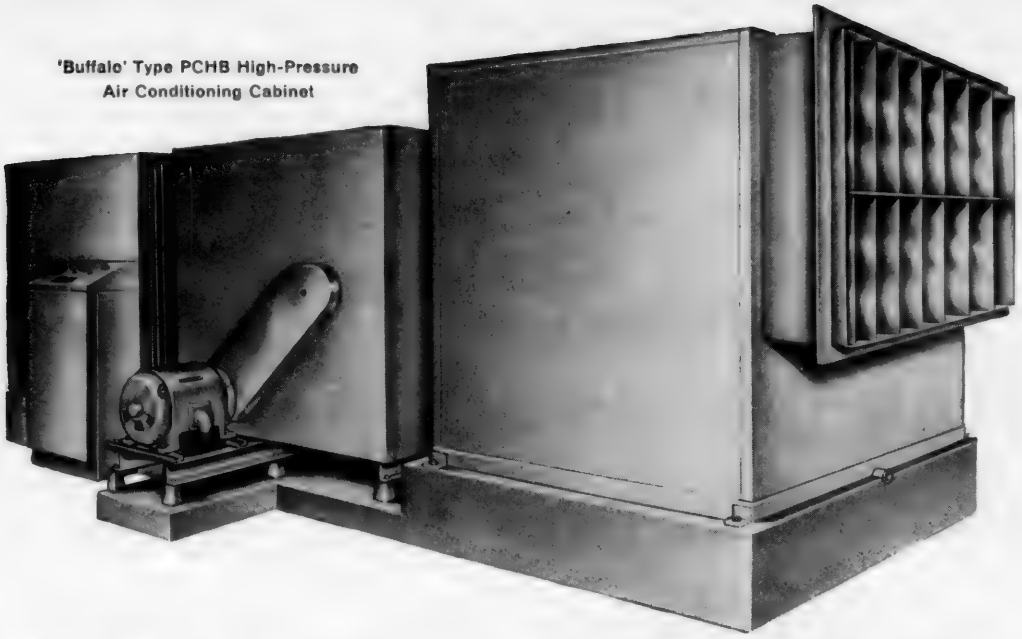
'Buffalo' Type PCHB High-Pressure Air Conditioning Cabinet



NEW 'BUFFALO' HIGH PRESSURE UNIT FOR MULTI-ZONE OR DUAL-DUCT AIR CONDITIONING SYSTEMS

Embodying all the proven construction features that made 'Buffalo' low-pressure Zone Control Cabinets popular with the industry, these new 'Buffalo' Cabinets are designed to operate at static pressures up to 8".

Check these quality features:

RUGGED, COMPACT COIL SECTION

- Husky tubular frame — removable panels counter flashed at all seams for minimum air leakage.
- Vertical or horizontal discharge models for minimum floor space or headroom requirements — no discharge elbow needed.
- Heavy-gauge zone dampers, stainless steel blade journals — zones individually sized for CFM requirements, for accurate adjustment of balancing dampers.

EFFICIENT TYPE BL FAN SECTION

- Isolated from filter and coil sections by flexible neoprene connections.
- Fan, motor and drive assembly rigidly held in permanent alignment by rugged integral structural channel base.
- Time proved Type BL Fan with characteristics of particular advantage in a high-pressure system: — high efficiency over broad operating range — low noise level — non overloading horsepower characteristic — steep constant rising pressure characteristic for minimum capacity change in switching from hot to cold deck operation — stationary inlet guide vanes for stable performance under adverse inlet conditions — low fan cutoff velocities eliminate need for bulky diffuser section, providing excellent coil velocity distribution with minimum coil wiping.

Write today for new Bulletin **AC-152**

AIR HANDLING DIVISION

BUFFALO FORGE COMPANY

Buffalo, New York

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

'Buffalo' Air Handling Equipment to move, heat, cool, dehumidify and clean air and other gases.

'Buffalo' Machine Tools to drill, punch, shear, bend, slit, notch and cope for production or plant maintenance.

'Buffalo' Centrifugal Pumps to handle most liquids and slurries under a variety of conditions.

Squier Machinery to process sugar cane, coffee and rice. Special processing machinery for chemicals.

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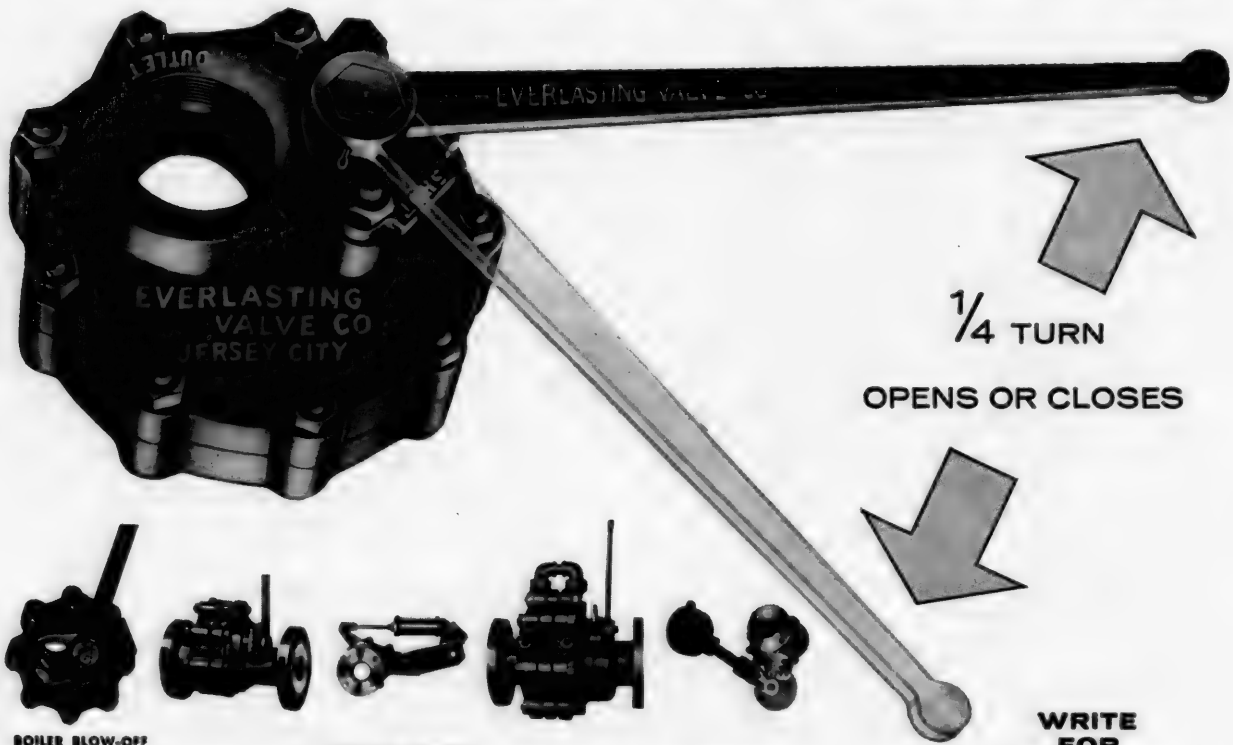
When you need fast, easy opening and closing with a leak-proof seal and straight-through flow with minimum pressure drop specify

EVERLASTING



BOILER BLOW-OFF
Quick acting, also handwheel operated "Y" and angle types. For pressures up to 600 psi.

GENERAL SERVICE
Where drop-tight seal and full flow is essential.

CYLINDER OPERATED
Can be remotely controlled, electrically or manually.

STEAM JACKETED
Assures free flow of viscous materials.

WEIGHT-OPERATED
For automatic drains or emergency shut off.

WRITE FOR BULLETIN

EV-409

EVERLASTING VALVE COMPANY, 75 FISK STREET, JERSEY CITY 5, N. J.

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In the busy months ahead...

INSIST ON

genetron®

SUPER-DRY REFRIGERANTS

...and be sure of the best!

General Chemical's advanced manufacturing techniques have helped bring new quality standards . . . new highs of purity and dryness for refrigerants. "Genetron" refrigerants are approved...accepted...and *preferred* as original charge and replacement in all types of modern refrigeration equipment.

See your wholesaler before the rush starts . . . make sure you're covered for all your refrigerant needs in the hurry months ahead. Be sure, also, to see the new "Genetron" Kit for field testing hermetic burnouts and the new pressurized "Genetron" 11 solvent cylinders for cleaning out mildly contaminated jobs; your "Genetron" wholesaler can tell you about this new "Genetron" service while you are there.

genetron 11 CCl_3F ORANGE LABEL TRICHLOROMONOFLUOROMETHANE
genetron 12 CCl_2F_2 WHITE LABEL DICHLORODIFLUOROMETHANE
genetron 22 $CHClF_2$ GREEN LABEL MONOCHLORODIFLUOROMETHANE
genetron 113 $C_2Cl_3F_3$ PURPLE LABEL TRICHLOROTRIFLUOROETHANE
genetron 114 $C_2Cl_2F_4$ BLUE LABEL DICHLOROTETRAFLUOROETHANE

"GENETRON" PRODUCTION CENTER

"Genetron" Super-Dry Refrigerants are produced in this giant fluorochemical center in Baton Rouge, La. . . . in Danville, Illinois . . . and will also soon be produced on the East Coast at a new plant now under construction at Elizabeth, N.J.

NEW! "GENETRON" 11 PRESSURIZED SOLVENT CYLINDER

Special pressurized cylinders of "Genetron" 11 solvent provide an ideal means for cleaning out mildly contaminated systems after burnout.

Allied Chemical

GENERAL CHEMICAL DIVISION
40 Rector Street, New York 6, N.Y.

This mark tells you a product is made of modern, dependable Steel.

"We've been buying from National Tube Distributors for almost 25 years—and they've never let us down."

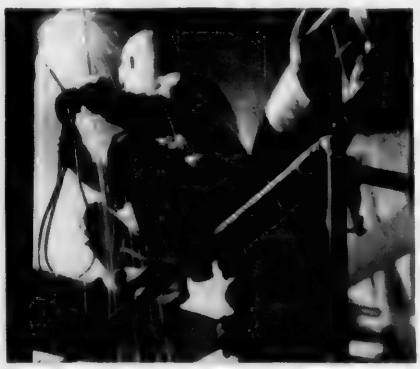
So says Mr. Stanley Carter, President, Stanley-Carter Company, Mechanical Contractors, Detroit, Michigan. *"Good distributor service is tremendously important to our profit margin. That's why we've been working with National Tube Distributors as long as we have.*

"We've never had a single project held up because of a late delivery from a National Tube Distributor—men and equipment tie-ups because of late shipments can waste a lot of money."

"We kept a big job right on schedule in Nashville, Tennessee, when the USS National Pipe arrived exactly at the time they promised it.

"It looked like we were headed for trouble on a big Detroit job this year. We needed a lot of pipe in a hurry. All it took was a few phone calls. We received the pipe within 24 hours."

"National Tube salesmen and distributors back us with technical assistance. They not only keep us abreast of changes in specifications but offer recommendations if specifications need to be changed."



"On this job, the distributor worked with the architect when a spec change was needed—the new specification was just as good for this particular job, and it saved us serious delays.

"A National Tube salesman helped recommend a specification equal to the original spec but for a less expensive material on a plant expansion job we were doing. Cut the cost about 10%."

"Another thing we like. These National Tube Distributors carry a complete stock of pipe sizes.

"And the quality is excellent. In the past 20 years, we've had no trouble with USS National Pipe. If trouble were encountered, we know help is as close as our telephone. We can call our National Pipe Distributor or National Tube, and the team goes into action immediately."

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National Tube Division of United States Steel

Columbia-Geneva Steel Division, San Francisco Pacific Coast Distributors
United States Steel Export Company, New York

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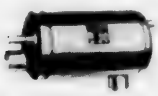
EVERY B&G® COMPONENT IN THIS TYPICAL INSTALLATION IS ALIVE WITH STAR FEATURES

B&G CONDENSERS

Lighter, more compact units, featuring quiet, vibration-free operation, uniform gas distribution, cleanable tubes and higher operating efficiencies.

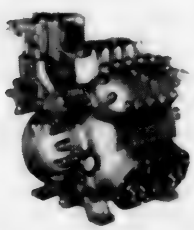
B&G EVAPORATORS

See illustration at right for features which give these units outstanding superiority.



B&G SUCTION LINE HEAT EXCHANGERS

Aid thermal expansion valve operation, prevent liquid slugging.

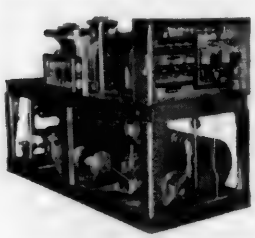


B&G COMPRESSORS

Precisely engineered for vibration-free operation with all the advantages of "open" units. All units have *one* bore—a few interchangeable parts service them all.

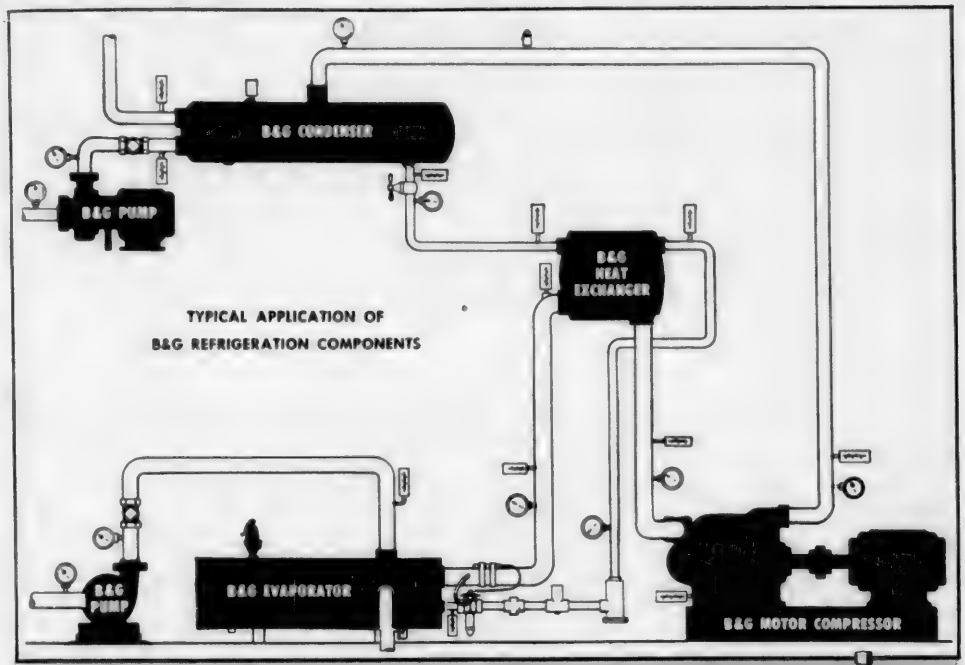
B&G CENTRIFUGAL PUMPS

A full range of *quiet* pumps for refrigeration and air conditioning systems.

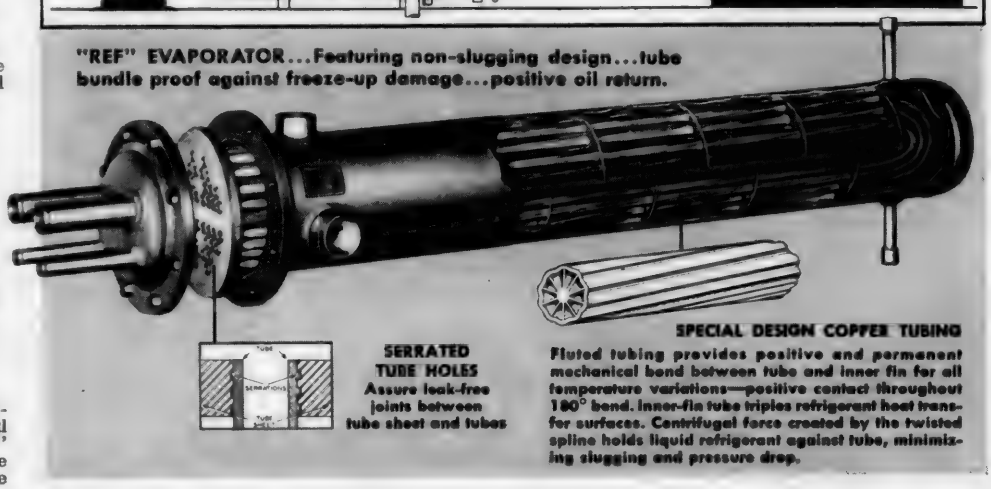


B&G PACKAGE LIQUID COOLERS

A completely integrated and assembled water chiller—the only unit of its kind with all major parts designed, built and guaranteed by one manufacturer.



"REF" EVAPORATOR...Featuring non-slugging design...tube bundle proof against freeze-up damage...positive oil return.



SERRATED TUBE HOLES Assure leak-free joints between tube sheet and tubes

SPECIAL DESIGN COPPER TUBING Fluted tubing provides positive and permanent mechanical bond between tube and inner fin for all temperature variations—positive contact throughout 180° bend. Inner-fin tube triples refrigerant heat transfer surfaces. Centrifugal force created by the twisted spline holds liquid refrigerant against tube, minimizing slugging and pressure drop.

B&G makes a complete line of refrigeration and air conditioning components—*with many commonly used sizes available for immediate shipment from factory stock!*

These are quality units throughout! B&G Evaporators and Condensers all offer *plus values* in efficiency and rugged, long-life construction. They are manufactured by methods which hold shell diameters exact and free of distortion. This permits tight fitting baffles with minimum liquid slippage, greater efficiency and easy replacement of tube bundles if ever necessary.

All units are built to A.S.M.E. Code requirements and are so stamped.

When selecting pumps, B&G Series 1522, 1531 and 1510-B Centrifugal Pumps invite your most critical comparison. They are of vertical split case design, equipped with the exclusive, leak-proof "Remite®" Mechanical Seal and noted for quiet, dependable operation.

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COMPANY
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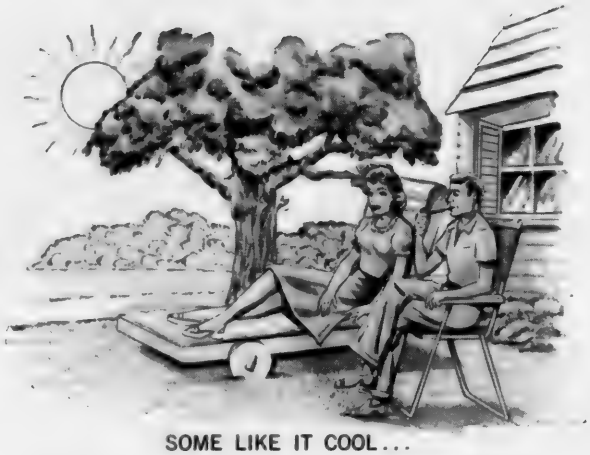
SOME LIKE IT HOT...



SOME LIKE IT COOL...

AGITAIR® solves these air distribution problems

with the

TRULY ADJUSTABLE Diffusers

AGITAIR®

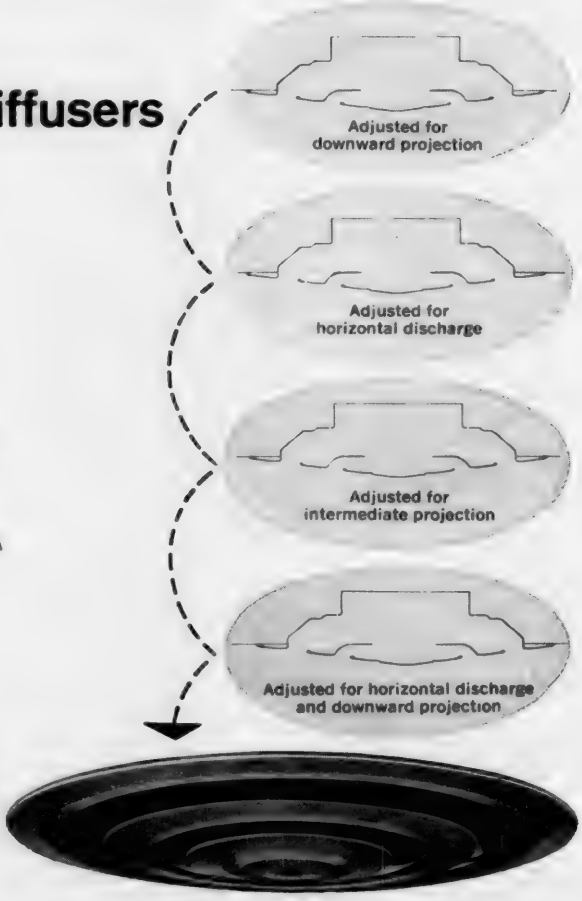
TYPE "OA"

With the distinctive AGITAIR "finger-tip control" you can adjust the air stream toward or away from any occupant to take care of all conditions.

AND—all air stream adjustments are made after the type OA has been installed without raising or lowering the spinnings. AGITAIR eliminates any uneven appearance to the ceiling line.

Every feature of AGITAIR circular diffusers has been designed to assure complete user satisfaction... appearance ... performance... noiseless, draftless air distribution—and the type OA is definitely easier to install.

For complete engineering data on these AGITAIR circular diffusers, ask your AGITAIR representative for catalog C-101 or write direct to Air Devices Inc.


Adjusted for downward projection
Adjusted for horizontal discharge
Adjusted for intermediate projection
Adjusted for horizontal discharge and downward projection

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GENUINE PRODUCTS

FOR BETTER AIR

high velocity units . . . air diffusers . . .
registers-grilles . . . filters . . . exhausters

AIR DEVICES INC.

185 MADISON AVENUE, NEW YORK 16, N.Y.

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100%

PETRO PAC

the boiler

the burner

the package

Why the PetroPac gen produces more heat p other generators

The flame, with its hot comb to the rear of the furnace and second pass to the front of the the fire cone is enclosed in a which support combustion bett ber. These two passes enable place. Carbon particles are co the furnace, leaving no unburn into the fire tubes to be cooled

Within the two-pass area t cooled crown sheet above a he the radiant heat. The soot-free consumed, then make a third fire tubes. Since there is only drop is minimal. The two-p provides exceptionally gener with a large amount of primar to direct radiant heat. Radian

A unique, new design forced draft firing of gas-oil combination

Forced draft, sealed combu merely vent. The new Petro forced draft against firebox pr tion system. Therefore, no c merely a vent. Operates equa

Perfect fuel-air ratio — perf factors required for total comb sharp precision. Both fuel a pin-point accuracy. The com only the controlled air supply port. Excess air cannot intrud secondary air ports, nor is disturbed by vagaries of natur

The PetroPac package seven ways . . . here the solutions, and the

1. THE PROBLEM—eliminate need ney or stack yet usable with chim

   THE SOLUTION—design a forc combustion burner-boiler packag

   THE RESULT—The PetroPac chimney draft unnecessary. Exha long or short, and can be as n smaller in diameter than a natural

2. THE PROBLEM—eliminate erro installation of on-site assembly

   THE SOLUTION—design a bo complete package.

   THE RESULT—a PetroPac pack on-site assembly. Boiler-jacket, bu shipped from the factory compl and ready for electrical and oil or Separate shipment of boiler and made if it is desired to protect controls against damage or va building construction.

3. THE PROBLEM—divided respo different manufacturers and con firing equipment, refractory, elec control system.

   THE SOLUTION — limit respo source.

   THE RESULT—Petro agent as responsibility for either the com separately shipped boiler and b fuel and air systems and factor panel and automatic control equi

nerator
er dollar than

bustion gases, travels first
then doubles back on the
furnace. The result is that
an envelope of hot gases
ter than a refractory cham-
100% combustion to take
mpletely consumed within
ned material to be carried
d and deposited as soot.
the water legs and a water
eat reflecting hearth absorb
hot gases, with fuel totally
and final pass through the
one tube pass the pressure
pass furnace arrangement
rous combustion volume
ry heating surface exposed
t heat transfer to the pri-

mary surface is far more effective than convective heat transfer to secondary heating surfaces. The greater proportion of radiant heat transfer surface in the PetroPac design, therefore, provides more capacity per square foot of heating surface. This results in higher capacities and lower stack temperatures, because there is less heat remaining to be absorbed in the tubes.

Another PetroPac advantage is this: since initial combustion is supported by an envelope of hot gases the combustion chamber does not require sidewall refractory. Furnace heat is absorbed directly into the water legs, with an enormous gain in heat transfer.

Standby loss, the greatest fuel waster of all, is reduced to almost nothing. This is due in part to the sealed combustion feature which prevents cold air infiltration, and partly to the elimination of boiler refractory with its large volume of stored heat which is ordinarily dissipated at relatively low temperatures during burner "off" periods.

Cuts service costs. Total combustion cuts service costs drastically. Since there is no sidewall refractory, costly fire-box maintenance is also eliminated.

n for
oil, or gas, or

ustion — no chimney,
oPac burner operates under
ressure in a sealed combus-
chimney draft is needed—
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fect combustion. All the
bustion are controlled with
and air are metered with
nbustion chamber receives
y through the burner firing
de through firebox vents or
s the combustion process
ral draft. The exact amount

of air insures an optimum fuel-air ratio for total combustion. The PetroPac flame starts clean and *stays* clean.

No pulsation—steady, even flame. PetroPac's unique burner head eliminates flame pulsation. A throbbing, puffing fire is not only a first-rate nuisance but a soot-producer and a waster of fuel. The PetroPac burner starts evenly and burns steadily.

Unique design — high efficiency firing. The new design PetroPac draft tube and firing head keeps the flame constant regardless of individual pressure and draft requirements.

The oil phase of the burner achieves maximum efficiency because of the precise volume of air which is released just ahead of the oil feed nozzle.

Multiple jets are used in the gas phase of the burner. As with oil, gas is discharged directly into the air stream but behind a vaned burner head. This provides a uniform mixture of air and gas a split second before both enter the combustion chamber.

e gets results
are the problems,
PetroPac results

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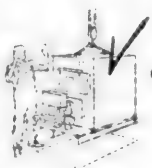
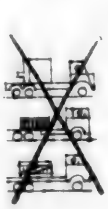
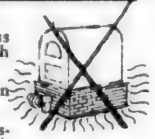




4. THE PROBLEM—elimination of high heat loss through refractory base, and standby loss through chimney.

THE SOLUTION—design a sealed combustion boiler.

THE RESULT—New PetroPac sealed combustion design prevents leakage of cold air through access doors, vents and around refractory base; eliminates heat retaining, heat wasting brick base and firebox refractory, and makes 'standby' loss negligible.



5. THE PROBLEM—stop periodic breakdown of maintenance-prone refractory sidewalls.

THE SOLUTION—completely eliminate buckling, spalling refractory sidewalls.

THE RESULT—PetroPac needs no refractory sidewalls—only an insulating refractory base which is virtually maintenance-free, and reflects radiant heat against the heat absorbing crown sheet.

6. THE PROBLEM—modern commercial and industrial construction often demands space-saving, low ceiling boiler rooms.

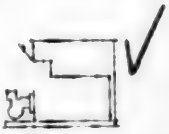
THE SOLUTION—design a boiler without a high refractory-lined base.

THE RESULT—PetroPac has reduced the height of the boiler base from three feet or more to only *three inches* by eliminating a refractory-lined base.

7. THE PROBLEM—how to provide easy access to tubes and combustion chamber.

THE SOLUTION—a boiler design that not only gives quick access to the tube bank but also provides space for entering the furnace itself.

THE RESULT—a boiler that has an opening behind the tube cleanout door, giving access to the furnace. Entire flame area can be easily seen through glass observation door without breaking seal.



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For your files

Complete data and specification sheets on all units.

Price data

Detailed price information on all sizes of generator units.

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Dealer franchises open in some areas.

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of quality heating and equipment since 1903

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da, 80 Ward Street,
onto, Ontario)

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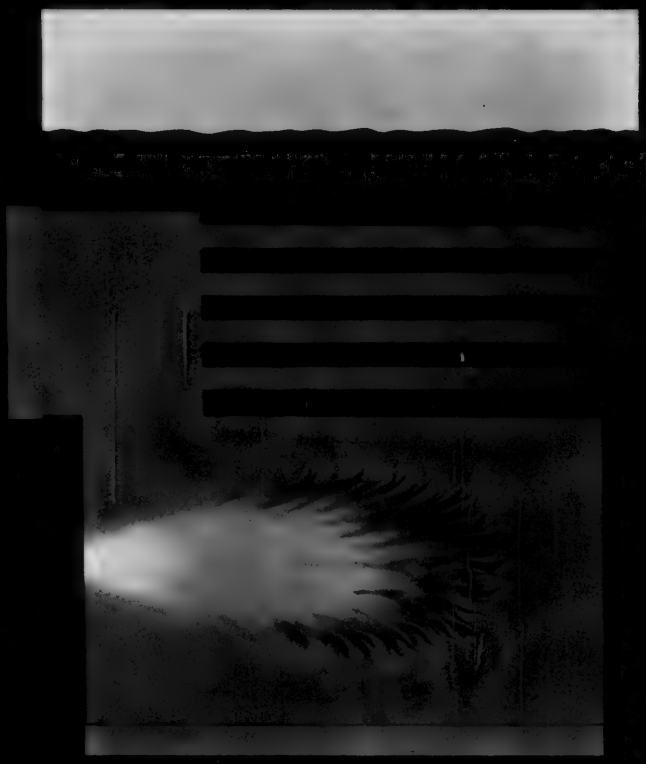
the new

PETRO PAC

generator



3-pass

big 2-pass

Complete, *total* combustion — before products of combustion enter the tubes — is the key to the remarkable economy of this advanced new package generator

specifications

RATINGS

UNIT NUMBER		PPF 324	PPF 396	PPF 504	PPF 648	PPF 792	PPF 1008	PPF 1260	PPF 1512	PPF 1800	PPF 2100	PPF 2400
Certified Output Steam or Water	MBTU/HR	324	396	504	648	792	1008	1260	1512	1800	Available Shortly	Available Shortly
Heating Surface	SQ. FT.	41	53	65	88	106	153	177	206	236		
Firing Rate No. 2 Oil	GPH	3.0	3.5	4.5	5.8	7.1	9.0	11.3	13.5	16.1		
Gas	MBTU/HR	432	495	630	810	990	1260	1575	1890	2250		
Burner Motor H. P.	GAS	1/4	1/4	1/4	1/4	1/2	1/2	1/2	1/2	1-1/2		
	OIL	1/4	1/4	1/4	1/4	1/2	1/2	3/4	3/4	1-1/2		
	GAS-OIL	1/2	1/2	1/2	1/2	1/2	1/2	3/4	3/4	1-1/2		

Standard equipment

Steel firebox boiler mounted on refractory lined platform base. The steel jacket is lined with insulation and factory mounted. Cleaning tools, cleaning and water conditioning compound are shipped with package.

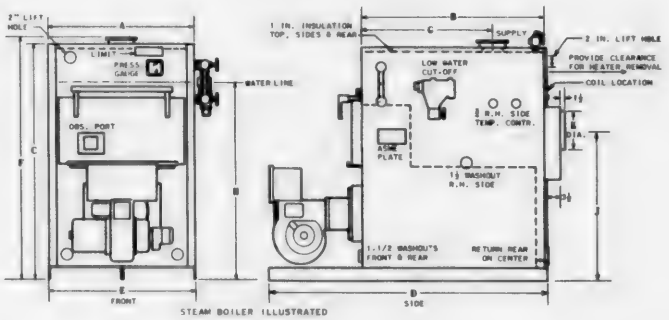
STEAM TRIM—Pressure gauge, ASME Code safety valve, water gauge glass, pressure limit control and a low water cutoff.

WATER TRIM—Combination altitude-temperature pressure gauge, ASME Code relief valve, and temperature limit control.

OIL BURNER—Forced draft fan, M-H RA890E electronic combustion safeguard (stack switch optional on PPF 396, PPF 504 and PPF 648), motor starting relay, (line starter ¾ H.P. and larger) electric ignition with ignition transformer, two-stage 300 psi fuel unit, and instantaneous cutoff solenoid oil valve.

GAS BURNER—Forced draft fan, M-H RA890E electronic combustion safeguard, motor starting relay, air flow safety switch, gas electric ignition assembly with 6,000 volt transformer, main and pilot gas pressure regulators, main and pilot manual shut off gas valves, main and pilot automatic gas valves, and manual on-off switch.

GAS-OIL BURNER—Same as gas burner plus gas-oil manual changeover switch, two-stage 300 psi oil unit with instantaneous cutoff solenoid oil valve.



STEAM BOILER ILLUSTRATED

DIMENSIONS

MODEL NUMBER	PPF 324	PPF 396	PPF 504	PPF 648	PPF 792	PPF 1008	PPF 1260	PPF 1512	PPF 1800	PPF 2100	PPF 2400
A - Boiler Width over Jacket	25 5/8	25 5/8	28	32	32	41	41	44	44	Available Shortly	Available Shortly
B - Boiler Length	32 3/8	40 5/8	43	43	50	57	65	61	69		
C - Boiler Height	44 1/8	44 1/8	48	53	53	66	66	69	69		
D - Overall Length	53 1/2	61 3/4	66	66	78	85	85	82	98		
E - Overall Width	26 1/2	26 1/2	28	33	33	42	42	45	45		
F - Supply Height	44 1/8	44 1/8	48	53	53	66	66	71	71		
G - Supply Location	21 5/8	29 5/8	27	30	30	33	33	35	35		
H - Water Line Height	36 5/8	36 5/8	40	44	44	54	54	58	58		
J - Vent Height	28 1/4	28 1/4	31	35	35	44	44	48	48		
K - Vent Diameter	7	7	8	9	9	10	10	12	12		
Supply Size	3	3	4	4	4	6*	6*	6*	6*		
Return Size	3	3	3	3	3	4	4	4	4		
Gas Manifold Size**	3/4	1	1-1/4	1-1/4	1-1/2	2	2	2	2		
Shipping Weight (Lbs. Approx.)	1300	1400	2000	2200	2600	3100	3500	3900	4400		

* American Standard Flange

** Based on minimum of 5" W.C. Gas Pressure and 1000 Btu Natural Gas.

TANK (STORAGE)

Coil No.	Available on Generator	Capacity 40-140° Rise Gallon Per 3 Hours 180°F B.W.	212°F B.W.	Coil Tapping Size	Clearance Req'd For Removal
70RS	PPF-324 thru PPF-1260	40	66	1	14"
71RS	PPF-324 thru PPF-1260	60	100	1	17"
72RS	PPF-324 thru PPF-1260	90	150	*1-1/4"	15"
73RS	PPF-324 thru PPF-1260	120	200	*1-1/4"	18"
74RS	PPF-324 thru PPF-1260	180	300	*1-1/4"	27"
75RS	PPF-396 thru PPF-1260	240	400	*1-1/4"	33"
76RS	PPF-792 thru PPF-1260	300	500	*1-1/4"	41"
77RS	PPF-1008 thru PPF-1260	360	600	*1-1/4"	49"
142CS	PPF-1512 thru PPF-1800	250	415	*1-1/4"	29-1/2"
143CS	PPF-1512 thru PPF-1800	300	500	*1-1/4"	30-1/2"
144CS	PPF-1512 thru PPF-1800	420	700	*1-1/4"	35-1/2"
145CS	PPF-1512 thru PPF-1800	500	830	*1-1/4"	41-1/2"
146CS	PPF-1800	600	1000	*1-1/4"	47-1/2"
152RS	PPF-1512 & PPF-1800	720	1200	*2-1/2"	45-1/2"
153RS	PPF-1800	840	1400	*2-1/2"	51-1/2"

INSTANTANEOUS

Coil No.	Available on Generator	Capacity 40-140° Rise Gallon Per 1 Hour 180°F B.W.	212°F B.W.	Coil Tapping Size	Clearance Req'd For Removal
81RTF	PPF-324 thru PPF-1260	210	350	3/4"	16"
82RTF	PPF-324 thru PPF-1260	270	450	1"	23"
84RTF	PPF-324 thru PPF-1260	360	600	1"	19"
85RTF	PPF-396 thru PPF-1260	450	750	1"	25"
86RTF	PPF-648 thru PPF-1260	600	1000	1"	31"
91RTF	PPF-792 thru PPF-1260	900	1500	1"	42"
162CTF	PPF-1512 thru PPF-1800	210	350	1"	28-1/2"
163CTF	PPF-1512 thru PPF-1800	300	500	1"	30-1/2"
164CTF	PPF-1512 thru PPF-1800	450	750	*1-1/4"	31-1/2"
165CTF	PPF-1512 thru PPF-1800	600	1000	*1-1/4"	37-1/2"
166CTF	PPF-1512 thru PPF-1800	750	1250	*1-1/4"	41-1/2"
167CTF	PPF-1800	900	1500	*1-1/4"	46-1/2"

* Male pipe thread, all others are female pipe thread.

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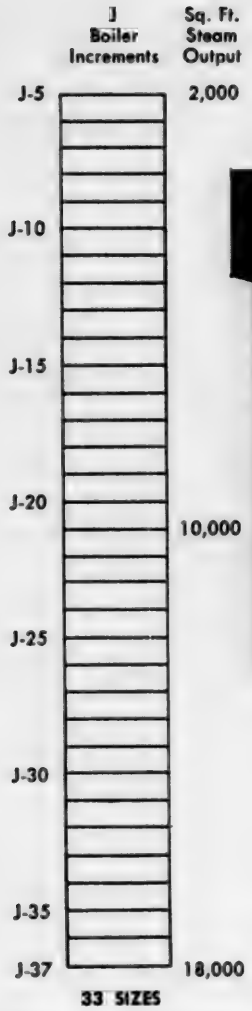
WHY OVERSIZE A GAS BOILER?

HERE ARE 33 SIZES, INCREASING IN STEPS OF ONLY 500 GROSS SQUARE FEET EACH!



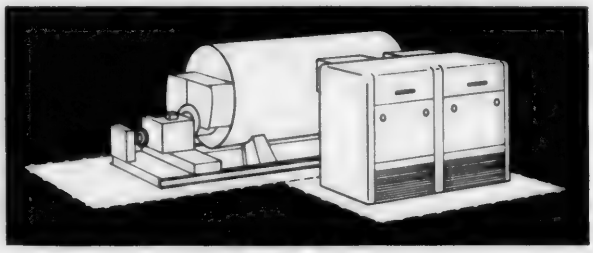
A.G.A. gross output
480,000-4,320,000 BTU per hr.

Send for Bulletin C-297

In Weil-McLain Type "J" Boilers, the flexibility of cast iron sectional construction has permitted the design of a complete line of boilers with sizes increasing in small increments. No need now to increase operating cost and boiler room size because of inability to closely match capacity to load.

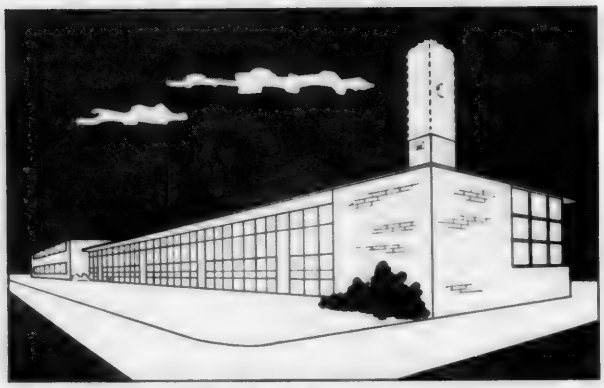
Close sizing is only one of many features offered by Type "J" Boilers. Others include:

1. Made of corrosion-resistant cast iron—with finned sections—internal steam separators—large flow tappings.
2. Ribbon burners assure amazingly quiet operation.
3. A.G.A. approved efficiency of 80%... approved for all gases.
4. Develop full capacity as rated by A.G.A. and I=B=R.
5. Available with A.G.A. approved dual fuel manifold.
6. Electronic controls and pre-wired control panels engineered as part of unit.
7. No refractories, no motors or fans, no tube replacement, no water treatment.
8. Fully insulated with foil-backed fibreglass.
9. All surfaces easily accessible for cleaning.



SAVES SPACE

Sketch shows the space saved by a 60 H.P. Type "J" Boiler over a typical scotch marine boiler of comparable rating. It is approximately one half as long, one foot less in height and only a few inches greater in depth, including space necessary for the draft hood. The required service area is smaller... and appreciably smaller if tube replacement is to be made through the rear door of the scotch marine boiler.



SAVES A CHIMNEY

A high chimney, forced draft or induced draft are not necessary for the proper operation of the "J" Boiler. All "J" Boilers can operate with a vent.

WEIL-McLAIN

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MICHIGAN CITY, INDIANA

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Impressive main entrance to Chicago's Exposition Center, magnificent new mecca for exhibitors and conventioneers. Inset, right, shows one arrangement of the many Dorex filters.

996 DOREX AIR RECOVERY FILTERS SAVE 800 TONS OF AIR CONDITIONING CAPACITY

. . . and provide relief from the irritant-heavy atmosphere of shows, conventions, exhibits

In the new 34 million dollar Exposition Center at McCormick Place, 996 high efficiency Dorex activated carbon filters—the largest installation of its kind in the world—purge recirculated air of irritants and purify it for sanitary re-use in the Center's vast air conditioning system.

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Steel pipe outlasts 20-year rink ...and begins service in another!

1940—Fresh from the mill, the Ammonoduct steel pipe begins its service life.

ALBETH ICE RINK, Allentown, Pa., was built in 1940 with 8 miles of Bethlehem 1¼-in. Ammonduct steel pipe, supplied by Lehigh Valley Supply Co. When the owner, A. G. Newhard, decided to roof over the rink, he first removed the coils of pipe—and found them exceptionally clean and free from interior or exterior corrosion! This 20-year-old pipe looked so good that he re-installed every length in the new 85 by 185-ft rink now operating on the same location.

When you need dependable refrigeration pipe, specify *steel* pipe—and get economy as a bonus. Any Bethlehem sales office will be glad to give you more information.

Steel

for Strength
. . . Economy
. . . Versatility

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA. *Export Sales: Bethlehem Steel Export Corporation*

BETHLEHEM STEEL

After serving 20 years in one ice rink, the Ammonoduct steel pipe was taken up during remodeling, brushed clean and recoated . . . and then every length was re-installed in a new rink on the same location.

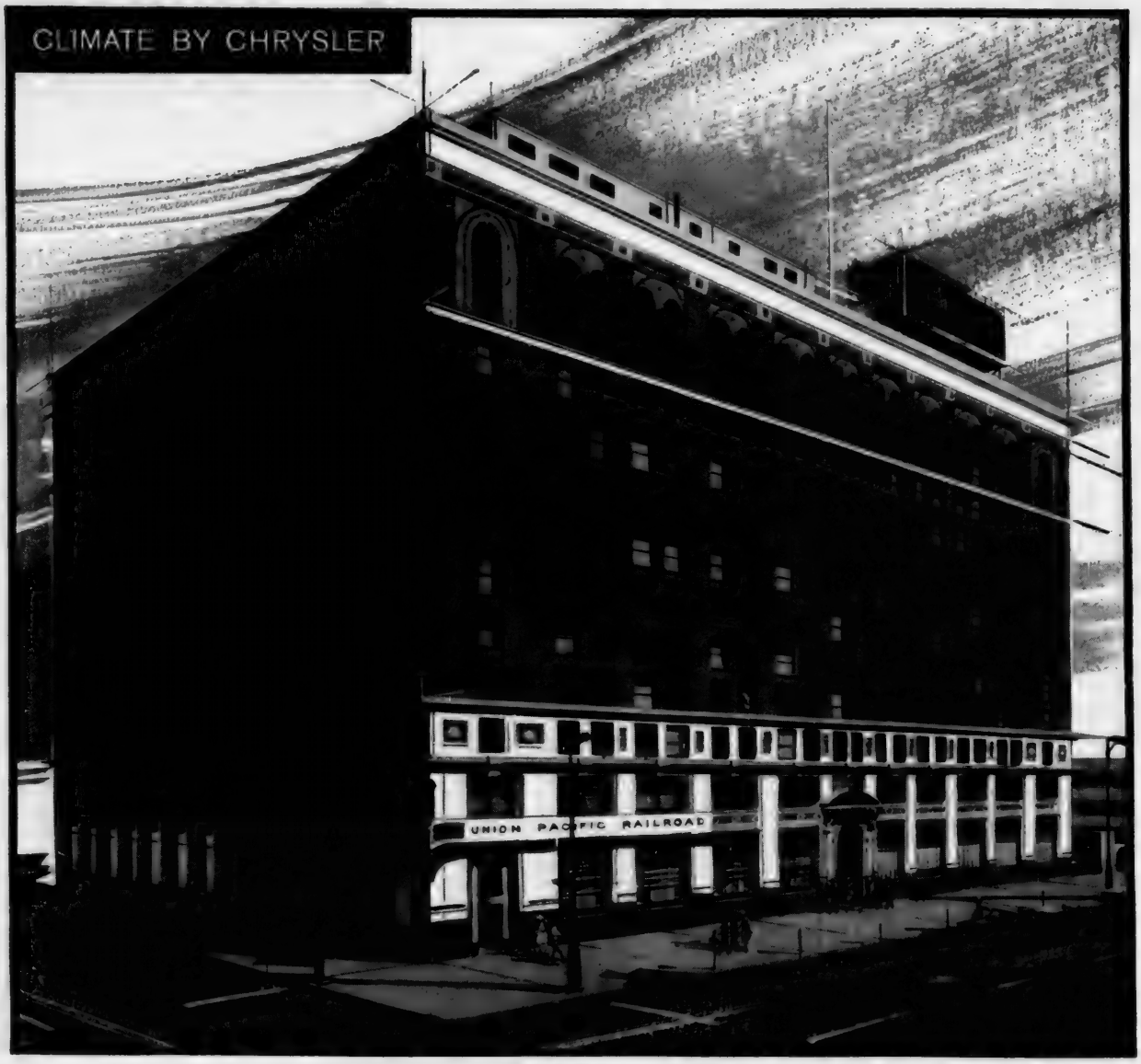
1960—Re-installed in the new rink, the steel pipe continues to perform perfectly.

Steel pipe is first choice for ice rinks

- costs less than any other ferrous piping material
- can be bent cold without danger of fracture
- always available in double-random lengths

BETHLEHEM STEEL

INSIST ON STEEL PIPE MADE IN U.S.A.



Union Pacific headquarters building, Omaha, Neb. Air Conditioning installation by Natkin & Co. ,Omaha

After taming 24 summers, Union Pacific replaces its air conditioning with more Chrysler Chillers

Shown above is the 12-story headquarters of Union Pacific Railroad, in Omaha, Nebraska. Since 1937, chilled water for its 850 tons of air conditioning has been supplied by Chrysler Liquid Chillers. This equipment has served through 24 simmering midwest summers without a single major difficulty.

So satisfied was Union Pacific that, when the time finally came to install new equipment, the company again specified Chrysler. Twelve new Chrysler Chillers—modern versions of the equipment that performed so satisfactorily—were ordered. Hooked in parallel, these units permit efficient zone and area cooling for every section of the building.

Chrysler packaged liquid chillers are rugged, light-weight and quiet. They run so smoothly they don't have to be bolted to the floor. And they don't require any special foundation.

Extra-long service life, with minimum maintenance, is a familiar story to owners of Chrysler Air Conditioning. But there's much more to the Chrysler product story. For complete data, or the technical cooperation of a Chrysler Engineer, write today.

CHRYSLER AIRTEMP

Chrysler Corporation, Airtemp Division, Dept. D-41, Dayton 4, Ohio

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No. 3 in a series for your SPEC. FILE †

Suggested specifications for insulating INDOOR CHILLED PIPING with G-B SNAP*ON® Glass Fiber PIPE INSULATION

DESCRIPTION

The effective reduction of heat gain in chilled piping hinges on the quality of the insulation. That's why G-B Snap•On, the original one-piece hinged pipe insulation molded entirely of fine glass fibers, is your best insulation buy. Ideal for cold and heated piping from sub-zero to 350° F., G-B Snap•On's thermal efficiency is second to none among all general purpose pipe insulations. Because it is made entirely of glass fibers, G-B Snap•On pipe insulation offers all the advantages of glass itself. It will not burn, rot, mildew, corrode or otherwise deteriorate. G-B Snap•On provides **permanent** insulation protection. What's more, its lightweight, highly resilient glass fiber construction makes it easy to handle and apply and highly immune to damage. G-B Snap•On is manufactured in thicknesses from ½" to 3" in 3' and 6' lengths.

MATERIAL SPECIFICATIONS

PLUMBING—thermal insulation for COLD WATER PIPING above 50°

Insulating Material—All cold water service piping shall be insulated with Gustin-Bacon Snap•On glass fiber pipe insulation in one piece molded sections ...." thick. Piping shall be clean and dry and shall be tested before insulation is applied.

CHILLED DRINKING WATER PIPING

Insulating Material—All chilled drinking water piping shall be insulated with Gustin-Bacon Snap•On glass fiber pipe insulation in one piece molded sections ...." thick with factory-applied vapor barrier jacket. Piping shall be clean and dry and shall be tested before insulation is applied.

AIR CONDITIONING & DUAL TEMPERATURE PIPING—thermal insulation for chilled water or combination hot and chilled water supply and return piping from 50° to 212° F.

Insulating Material—All chilled water or dual temperature heating and cooling lines to air conditioning equipment and return shall be insulated with Gustin-Bacon Snap•On glass fiber pipe insulation in one piece molded sections ...." thick with factory-applied vapor barrier jacket. Piping shall be clean and dry and shall be tested before insulation is applied.

APPLICATION SPECIFICATIONS

All covering shall be applied to the pipe with end joints tightly butted and the single longitudinal seam closed.

Ends of pipe insulation shall be sealed off to the pipe with vapor barrier adhesive or mastic at all flanges, valves, fittings, hangers, and at intervals of not more than 12' on continuous runs. Hanger rods in direct contact with the pipe shall be insulated separately for a distance upwards of 6" to 12". At hangers where pipe is supported by the insulation an 18 gauge metal saddle shall be provided under the insulation outside of the vapor barrier jacket. Its length shall be three times the pipe diameter with a minimum of 10". Jacket end joints shall be covered with factory furnished vapor barrier tapes secured with vapor barrier adhesive and staples or aluminum bands.

EXPOSED PIPING

WHITE COATED VAPOR BARRIER JACKET All piping exposed to view shall be insulated with factory furnished white coated jacket applied as above except use of clear quick tacking adhesive.

CONCEALED PIPING

VAPOR BARRIER JACKET WITH FLAPS STAPLED AND SEALED Longitudinal insulation seam shall be closed by stapling the factory applied jacket overlap with outward clinch staples on 3" centers after overlap has been coated with vapor barrier adhesive. All staples shall be coated with vapor barrier adhesive.

VAPOR BARRIER JACKET FLAPS BANDED AND SEALED Longitudinal insulation seam shall be closed with copper-clad insulation staples inserted across the seam and at an angle with the pipe surface. Vapor barrier jacket overlap shall be adhered over the staples with a quick tack vapor barrier adhesive. Three bands per section to be applied after jacket and tapes are sealed.

(CUT ALONG THIS LINE)

RECOMMENDED JACKETS FOR G-B SNAP*ON PIPE INSULATION FOR CHILLED PIPING

Ordering Name	Description	Sec. Length	Vapor Barrier	Where to Use
Dual-Temperature Jacket	A three layer laminate of 2 asphalt saturated crepe paper sheets adhered to each side of a .001" aluminum foil. Moisture vapor transmission rate of less than .01 perms. Factory applied with either black or white surface and a 2" longitudinal flap for sealing seam. 4" tapes for sealing end joints factory supplied.	3'	Yes	On interior cold water, dual temperature service and refrigerant lines. Available in black finish for concealed work, or white finish where appearance is important. When used out of doors an additional weatherproofing jacket is required.
Flame Resistant Jacket	One layer of 40-lb. flame resistant crepe Kraft laminated to a .001" aluminum foil with fire retardant asphalt. Moisture vapor transmission rate of less than .01 perms. This jacket has passed laboratory flame resistant tests ASTM D 777-46 and TAPPI-T-46LM-48 as follows: After flame time 0 to 1 second. After glow time 0 seconds. Furnished with a 2" overlapping longitudinal seam and 4" wide tapes to seal end joints.	3'	Yes	On interior cold water, chilled, dual-temperature service and refrigerant lines where flame resistant characteristics are required. The aluminum foil surface presents a finished appearance. When used out of doors an additional weatherproofing jacket is required. (NOTE: Unless otherwise notified, Aluminum Foil is applied next to pipe insulation.)

† Complete series of G-B Snap•On specifications will appear in this publication in the coming months. Each will be designed to be clipped from the publication and placed in your spec file. However, if you would like to have all G-B Snap•On specifications at this time, simply write:

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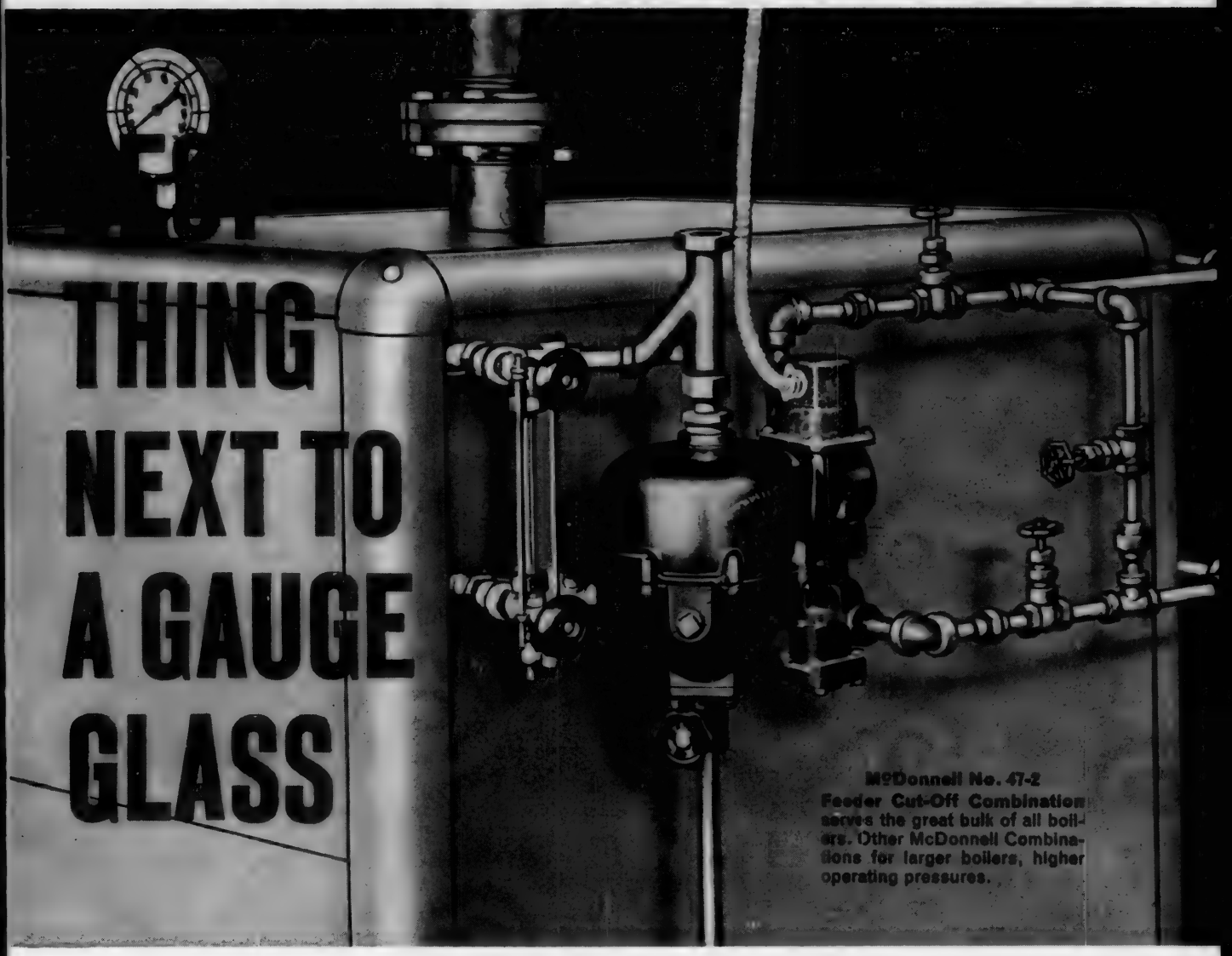

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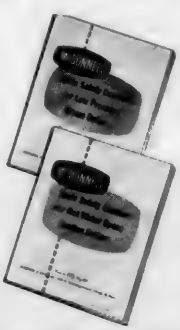
McDonnell Feeder Cut-off Combination

It's a story that cannot be repeated too often. A low water condition can happen in any boiler, at any time, for any of dozens of reasons. And that includes hot water boilers too, *where you don't even have a gauge glass to begin with.* ☆ There are two accepted approaches to the problem—a boiler feeder which adds water *mechanically* as needed to maintain a safe level, or a low water cut-off which acts *electrically* to stop the burner if water level gets too low. ☆ If each one is a good idea, then it stands to reason that the one best answer is to use both together—a combined mechanical feeder and electrical cut-off. ☆ No one will argue with you either if you make your choice from the McDonnell line of feeder cut-off combinations—the best-known, most widely used products of their kind.



Here are the facts that will enable you to tell your story with complete conviction. Step by step they show just what controls are needed, and where, and why—in simple terms even your customers can understand. There's one for Steam Boilers (Bulletin L-711) and a companion one on Hot Water Boilers (Bulletin P-30). Write for your copies.

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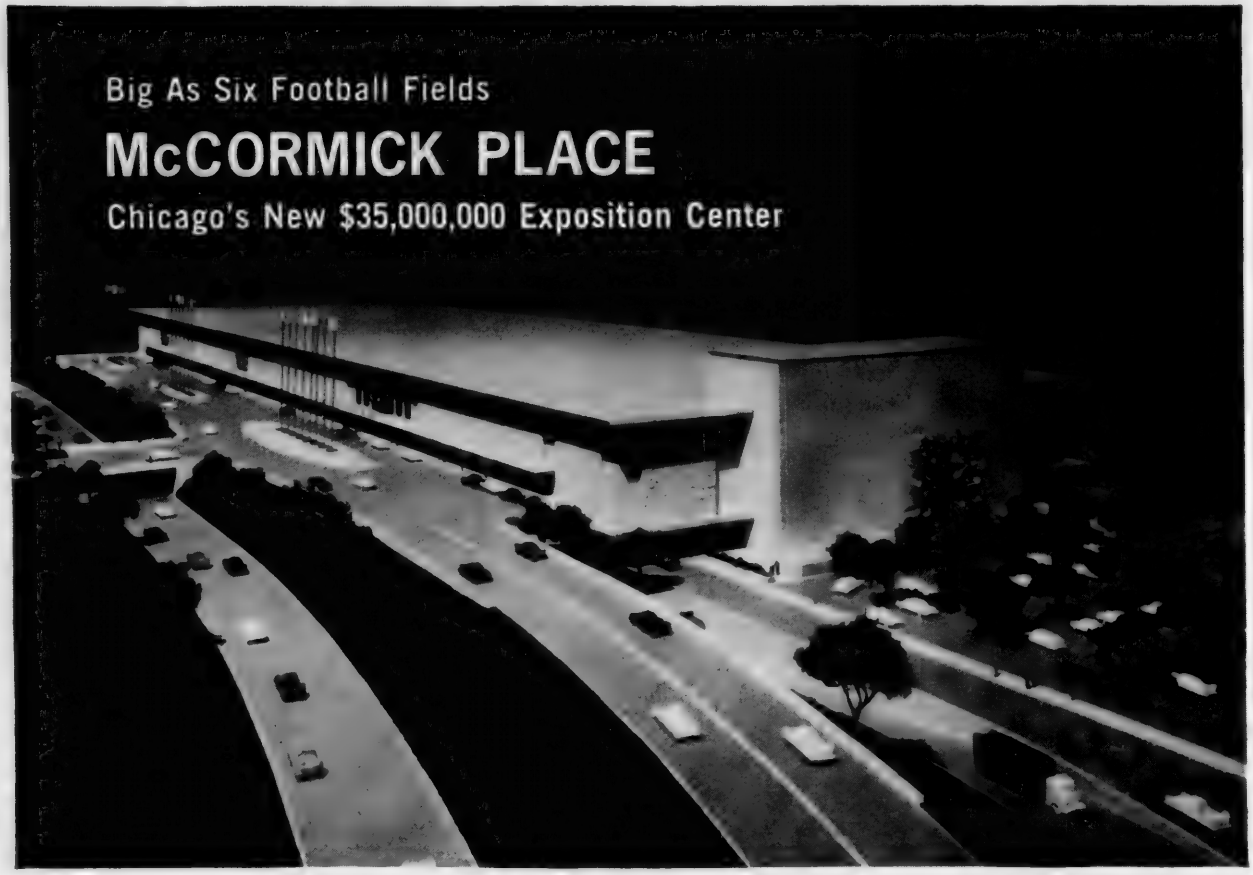
Owner: METROPOLITAN FAIR AND EXPOSITION AUTHORITY, CHICAGO, ILL. *Chief Architect:* ALFRED SHAW OF SHAW, METZ AND ASSOCIATES.
Architectural Consultants: JOHN W. ROOT OF HOLABIRD & ROOT . . . VICTOR HOFFER . . . EDWARD STONE. *Consultant Mech. & Elec. Engineers:* JOHN DOLIO & ASSOCIATES.
General Contractor: GUST K. NEWBERG CONSTRUCTION CO. *Heating & Air Conditioning Contractor:* DELL CORPORATION.



JENKINS VALVES control lines in mammoth heating – air conditioning system

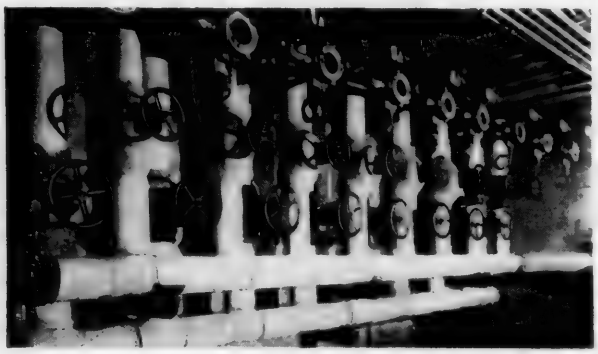
IT'S BIG, the main exhibit area is 320,000 square feet, almost free of pillars, with a 40-foot ceiling! The theater seats 5,000 people. Restaurant facilities can feed as many in an hour. Loading docks accommodate 50 trailers.

Volume-wise, this "first exposition hall designed specifically for the purpose" is almost as big as New York's Empire State Building . . . another famous architectural and engineering achievement equipped with Jenkins Valves. To air condition McCormick Place requires refrigeration capacity of 4,000 tons. To heat it, boiler capacity of 2,400 horsepower is needed.

A BIG JOB FOR VALVES is evident here. And, an opportunity to assure big savings with valves that ask for only minimum maintenance. The building experts responsible for McCormick Place called for Jenkins Valves to control the service lines in the mammoth complex of heating and air conditioning.

To keep your valve maintenance and replacement costs down, follow the lead of the experts. Specify *Jenkins* Valves. They *cost no more to buy* . . . and over the long, hard pull they cost considerably less. Jenkins Bros., 100 Park Avenue, New York 17.

SOLD THROUGH LEADING DISTRIBUTORS EVERYWHERE



Jenkins Valves control lines from eight 30,000 gal. oil tanks.

JENKINS
LOOK FOR THE JENKINS DIAMOND
VALVES
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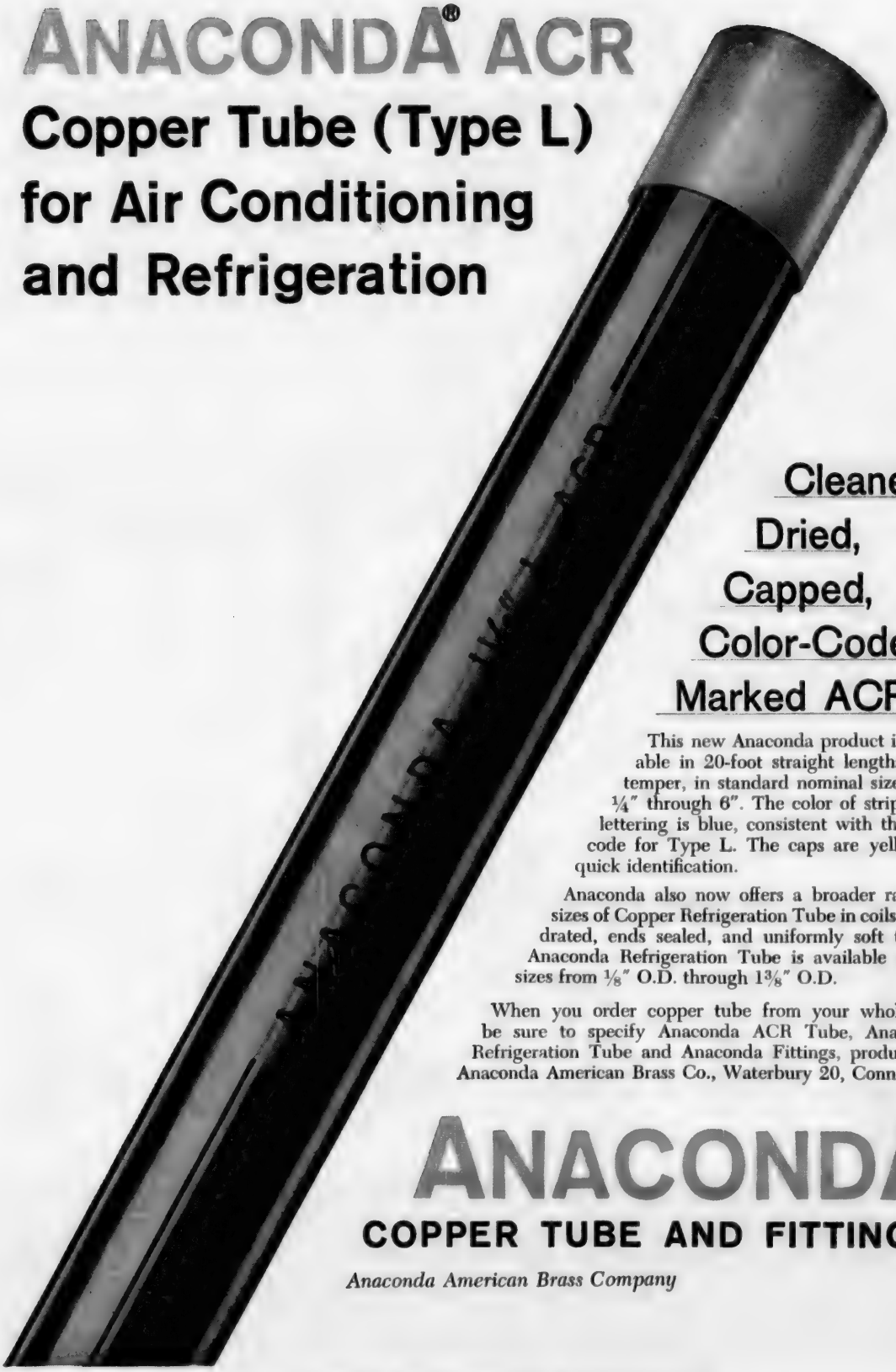
Now available

ANACONDA® ACR
Copper Tube (Type L) for Air Conditioning and Refrigeration



Cleaned, Dried, Capped, Color-Coded, Marked ACR.

This new Anaconda product is available in 20-foot straight lengths, hard temper, in standard nominal sizes from ¼" through 6". The color of stripes and lettering is blue, consistent with the color code for Type L. The caps are yellow for quick identification.

Anaconda also now offers a broader range of sizes of Copper Refrigeration Tube in coils—dehydrated, ends sealed, and uniformly soft temper. Anaconda Refrigeration Tube is available now in sizes from ⅛" O.D. through 1⅜" O.D.

When you order copper tube from your wholesaler be sure to specify Anaconda ACR Tube, Anaconda Refrigeration Tube and Anaconda Fittings, products of Anaconda American Brass Co., Waterbury 20, Conn. ACO L

ANACONDA®
COPPER TUBE AND FITTINGS

Anaconda American Brass Company

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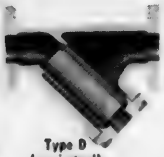
ONE STOP SHOPPING FOR AND AIR CONDITIONING

SARCO RADIATOR TRAPS, TYPE H

Sarco Type H Radiator Trap, angle pattern

Standard traps for all types of two-pipe steam heating systems. Suitable for pressures from highest vacuum to 25 psi. Require no adjustment in service. Removes air and condensate from radiators or convectors rapidly, completely, without steam waste or noise. Vertical traps are designed for bottom connected convectors to facilitate installation and cleaning.
Bulletin No. 155

SARCO PIPELINE STRAINERS



Type D (semi-steel) flanged, 125 and 250 psi

Types AT (semi-steel) 250 psi and BT (brass) 250 psi

Type CT (cast steel) 600 psi

For condensate, steam, water, oil, air, gas, and other piped fluids

Effective, inexpensive insurance against costly shutdowns and heavy repair bills. Installed ahead of the equipment, they protect the working parts of temperature and pressure regulators, steam traps, pumps, meters, burners, compressed air equipment, hydraulic systems, lubricators, and nozzles.

Standard screen used in Sarco strainers is constructed to prevent particles from by-passing the screen at the ends.

Rigid construction prevents rupture of screen when sediment creates abnormal pressure differentials. No weave-crevices to trap particles, and, therefore, more readily cleared by the use of the blow-down connection.
Bulletin No. 1210

SARCO BALANCING FITTINGS

Type 10 Series Angle Union Pattern Thread Type

Type 40 Series Straightway Union Pattern Sweat Type

Type 50 Series Straightway Screwed Pattern

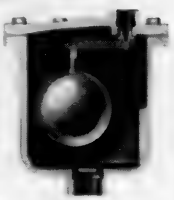
Type 60 Series Straightway Soldered Pattern

For balancing branch or circuit resistance of radiators, convectors, heating or cooling coils, unit heaters, and other heat transfer surfaces employing hot or chilled water. Unique solid segment stem assures linear straight line flow not obtainable with butterfly stems. Maximum water pressure 200 psi cold liquid—non-shock; 175 psi, 250°F. temperatures.

Available either in standard construction or with integral manual air vent in 3 standard patterns: angle union, straightway union, and straightway female connection. Both screwed end and sweat types. Twenty-six different patterns and sizes.

Bulletin No. 225

SARCO HIGH CAPACITY AIR ELIMINATORS FOR WATER



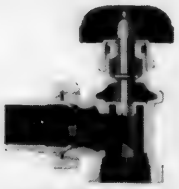
Type 13W For Water Heating and Cooling Systems

Type 13W and 13WH vent air from radiant or hot water heating systems, high pressure, high temperature hot water lines, chilled and condenser water lines in air conditioning installations, and process liquid lines — eliminate air pockets that prevent or retard circulation. Float-controlled discharge valve vents air rapidly through large orifice. Float action prevents escape of fluid.
Maximum pressure ratings: No. 13W — 150 psi; No. 13 WH — 300 psi.
Bulletin No. 170

SARCO VALVES FOR WATER

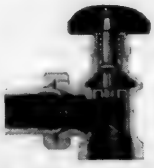
No. 37 Quick-Opening

No. 129 Convector and Radiator Gate



No. 157 Sleeve Type

No. 127 Convector and Radiator Gate



No. 167 Sleeve Type

Bulletin No. 225

SARCO

SARCO COMPANY, INC.
635 MADISON AVENUE, NEW YORK 22, N. Y.
PLANT: BETHLEHEM, PA.
STRAINERS • HEATING SPECIALTIES

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QUALITY HOT WATER, STEAM, SPECIALTIES...FROM SARCO

SARCO FLOAT-THERMOSTATIC STEAM TRAPS FOR 0-15 PSI

Type FT ¾", 1", and 1¼"
Bodies and covers of semi-steel (rated at 125 psi). Stainless steel valve and mechanism.

Type FTL 1½" and 2"
Bodies and covers of semi-steel (rated at 125 psi). Stainless steel valve seats. Renewable bronze valve heads.

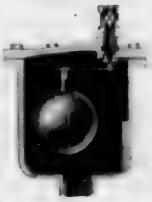
Sarco Float-Thermostatic steam traps discharge condensate at steam temperatures continuously and without shock. Air binding impossible — separate thermostatic air vents remove automatically and continuously all air and incondensable gases reaching the trap. Balanced pressure vent self-adjusts to all operating pressures, and location above condensate level permits discharge of air and gases reaching trap after start up. Do not require adjustment when pressures change.
Bulletins No. 450 & 455

SARCO AIR ELIMINATORS FOR STEAM

For Low Pressure Steam Heating Systems

Type 6, 6T, and 13-S Air Eliminators vent air from radiators and piping rapidly and completely. Float valve design prevents spillage. Check valve prevents air return under vacuum.

Types 6 and 6T have brass heads and seats, cast iron body. Body of 13-S is semi-steel with stainless steel head and seat. Pressures to 15 psi.
Bulletin No. 170

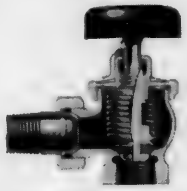


Type 13-S Air Eliminator

Type 6 Air Eliminator

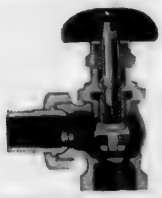
SARCO RADIATOR VALVES FOR STEAM

Gate Valve, Reinforced Packless Bonnet
129 — Double wedge disc convector gate valve with female union inlet, male threaded outlet. Max. pressure — 60 psi.



Bellows Packless Radiator Valve
45A — Valve stem positively sealed by flexible bellows of heavy-wall, helically-corrugated, bronze tubing. Modulating, non-modulating, and lock-shield types, angle and straightway patterns. Max. pressure — 25 psi.

Gate Valve
127 — Double wedge disc gate valve, female union inlet, male threaded outlet. Can be repacked under pressure. Available in a variety of connections. Max. pressure — 125 psi.



Reinforced Packless Bonnet
1141 — Vapor-tight stem, quick-opening, non-rising, with renewable composition cone disc. Max. pressure — 60 psi.

Bulletin No. 225

SARCO DOMESTIC WATER BLENDERS, TYPE DB

Maximum Working Pressure, 125 psi

Designed for use with submerged heating coils in residence or apartment heating boilers and external submerged coil heaters piped to heating boilers, where the pressures on cold and hot water supplies are balanced. Because the water in the boiler varies in temperature with the steam pressure carried, or the heating load, service hot water may be delivered to the fixtures at boiler water temperature.

The DB blender prevents this by automatically adding enough cold water to the hot discharge from the heater coil to maintain the desired moderate water temperatures to the fixtures.

Adjustable between 120°F. and 160°F. Any other range, covering 40°F. can be supplied at extra charge.
Bulletin No. 800

Plus . . . SARCOTHERM TEMPERATURE CONTROL SYSTEMS

These outdoor weather-compensated heating control systems are custom planned for schools, office buildings, hospitals, apartment buildings, developments.

- Maintain uniform inside temperature by automatically adjusting flow of hot water or steam to compensate for changes in outdoor temperature and room load demand.
- Insure low installed cost . . . with fewer controls, less wiring.
- Special drawings furnished for each job. On-the-job assistance from Sarcotherm's field engineers.

ALSO AVAILABLE: steam traps, Sarcofin and Sarcopak radiation, access boxes, temperature controls, vacuum and condensate pumps, and thermometers.

5924

SARCOTHERM

SARCOTHERM CONTROLS, INC.
AN AFFILIATE OF SARCO COMPANY, INC.
635 MADISON AVENUE, NEW YORK 22, N.Y.

CONTROL SYSTEMS FOR STEAM, HOT WATER, AND RADIANT HEATING

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. . . I can get just the fin spacing, tonnage and CFM I want."

Now, Halstead & Mitchell gives you a choice of 6, 7, 8 or 10 fins per inch . . . makes it much easier to match a central fan-coil unit to a particular job or to meet specifications.

And look what else H&M offers: a selection of three coil face areas for each model; direct expansion or chilled water cooling coils (1 to 8 rows); hot water, standard steam or non-freeze steam heating coils (1 or 2 rows); cooling capacities of 3 to 92 nominal tons with 880 to 47,750 CFM; Turbu-Flo coils arranged for right or left-hand connections; horizontal or vertical mounting for discharge in any direction . . . and every accessory item you need to simplify your installation.

Why don't you check H&M Central System Air Conditioners? Call your wholesaler or write for Bulletin AHU-100. Halstead & Mitchell Co., Dept. B4, Bessemer Bldg., Pittsburgh 22, Pa.

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AIR HANDLER

HM
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Central System Air Conditioners · Air-Cooled Condensers · Cooling Towers · Water-Cooled Condensers

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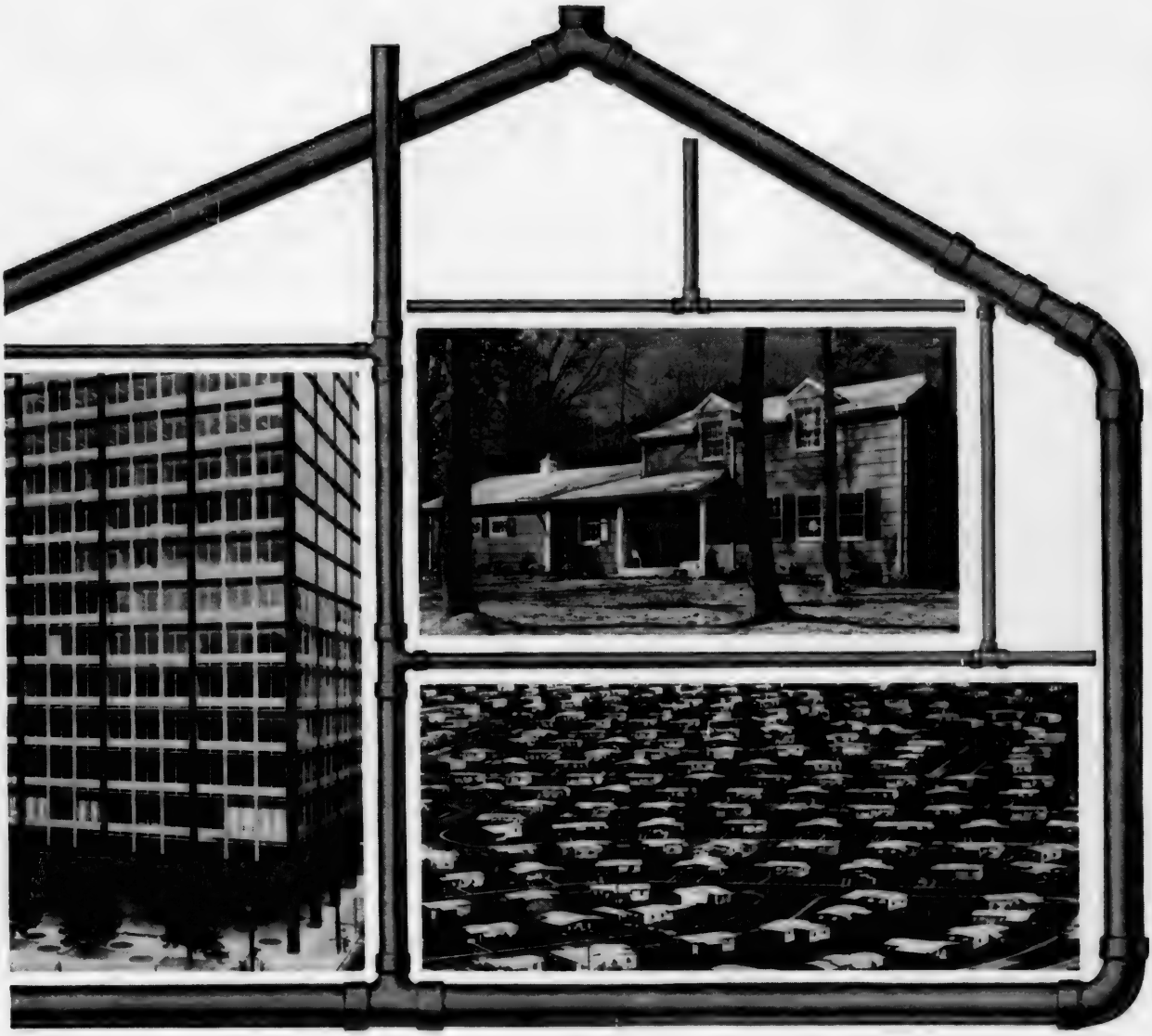

Builders WHO KNOW COSTS TO THE DOLLAR CHOOSE COPPER WATER TUBE

Cost-conscious tract and development builders insist on all-copper plumbing *after* thorough analysis of total job costs. They know that when equipment, labor and materials expense are added up, the all-copper plumbing job is less expensive and more profitable. They also know that home buyers see copper plumbing as a sign of house quality. Benefit from their experience.

Plumbers WHO KNOW QUALITY FIND IT IN BRIDGEPORT TUBE

This is American-made tube at its best, thoroughly tested and carefully packaged to make plumbing as easy and dependable as possible. Plumbers have used Bridgeport water tube, drain and vent line for years, and find it unsurpassed in quality.

BRIDGEPORT AMERICAN-MADE TUBE AND PIPE...AT ITS BEST

BRASS COMPANY BRIDGEPORT 2, CONNECTICUT Bridgeport

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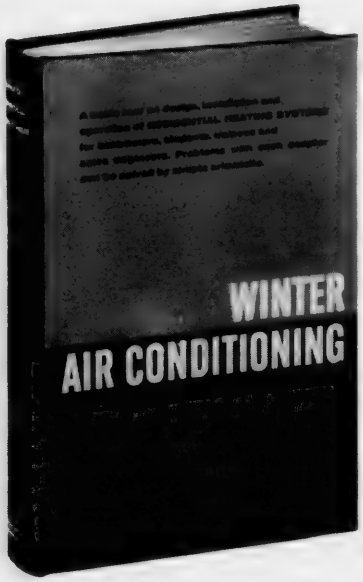
WINTER AIR CONDITIONING



THE COMPLETE AUTHORITY ON RESIDENTIAL HEATING

by Seichi Konzo

J. Raymond Carroll

Harlan D. Bareither

Mechanical Engineering Department, University of Illinois

This is a basic text on design, installation, and operation of residential heating systems. Written as a self-study or classroom training text, with problems and solutions for each chapter, it is also a complete working reference book for contractors, sales engineers, students and trainees. The authors are on the staff of one of the world's foremost centers for home-heating research. They have written the *why* and *how* of residential heating in terms that need no more than ordinary knowledge of arithmetic.

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V461B

NEW!

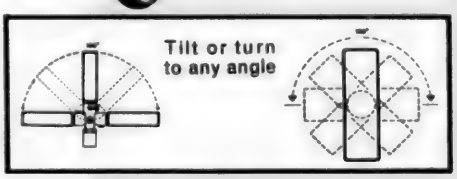
MARSH *Dial Thermometers*

Designed expressly for piping and duct work

One careful look at this new line of Marsh instruments will convince you that we have put into them *everything* that has been so long and widely needed in dial thermometers for piping and duct work . . . thermometers for use on heating and cooling equipment—for piping, air ducts, vessels and kilns, ovens and similar installations.

THE LINE IS COMPLETE. Four types, 7 ranges . . . 72 combinations to meet almost every conceivable condition as listed on the reverse side of this page. All have basic features that are found only in the Marsh line:

FAR MORE READABLE. Big, legible 3½" and 4½" dials . . . easy to see in places where piping and duct thermometers must be located. An even greater contribution to ease of reading is the provision for tilting and turning dials to any required angle of vision as diagrammed here and on the following page. No more climbing ladders or using flashlights to read obscure glass tube thermometers. And note that the line includes distant reading types that bring the dial into view even if the point of measurement is completely out of range.



UNBREAKABLE. Instead of the fragile glass tube thermometers customarily used for piping and duct work you now have the sturdy, unbreakable Marsh Dial Thermometer . . . long recognized as the best; now still more highly perfected.

MORE ACCURATE. Guaranteed accurate to plus or minus one division of the big open scale, these instruments have far greater *readable* accuracy than any glass tube thermometer. They also have the famous Marsh "Recalibrator"—to *keep* them accurate.

MORE ADAPTABLE. Your needs "designed" these instruments! Notice in the specifications on the following page how their design provides for every field condition. Separable sockets ("wells"), along with swivel nut for attachment of thermometer to socket, makes them easy to install—or to disconnect for servicing. Extension necks take care of insulated piping or ducts. Long stems in duct types place temperature-sensitive section where it should be for accurate indication.

To know the full scope of this new Marsh line read the specifications on the reverse side of this page. Every instrument in the line is—

Available from stock

Write for Bulletin PD

For piping

Dial Sizes: 3½" and 4½".

Ranges: 0° to 100° F for chilled water.
20° to 120° F for condenser water.
40° to 240° F and 100° to 300° F for hot water and domestic water.

¼" NPT male connection.

For ducts

Dial Sizes: 3½" and 4½".

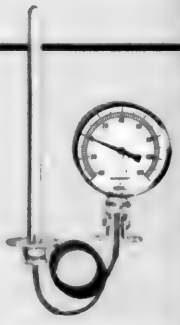
Ranges: minus 40° to plus 120° F; 0° to 160° F; 0°—220° F for ducts, kilns, ovens and similar jobs.

See reverse side for listing of sockets, flanges and stems.

Also remote reading

Piping and duct thermometers of same basic design are available with six feet of capillary tubing as shown.

See reverse side for listing of sockets, stems, ranges, etc.



. . . . Specifications on reverse side

specifications OF MARSH PIPING AND DUCT THERMOMETERS

(read complete description on preceding page)

PIPING THERMOMETERS

Piping thermometers are the Vapor Tension type which permits wide divisions in the important reading area (see cuts). They are standard with Marsh "Recalibrator." Both direct mounting and remote reading types, as illustrated here, are standard as follows:

Two sizes:

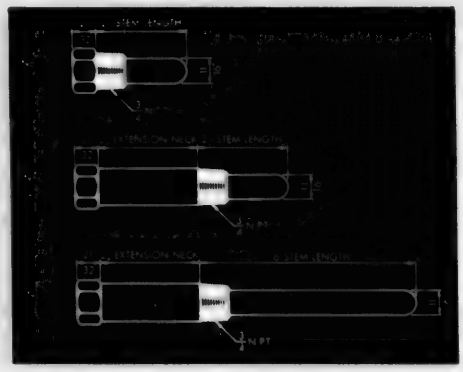
3½" and 4½" dial size.

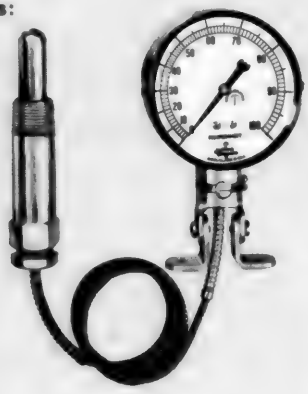
Four ranges:

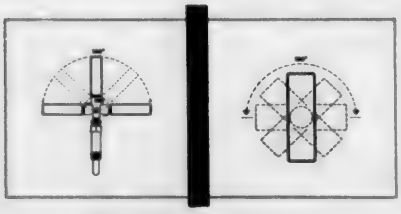
0° to 100° F for chilled water.
20° to 120° F for condenser water.
40° to 240° F for hot water heating and domestic hot water.
100° to 300° F for hot water heating and domestic hot water.

Connection

¾" NPT male.

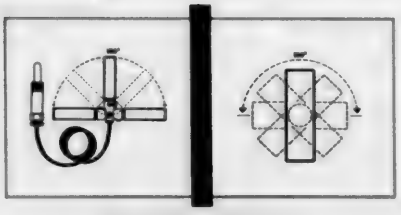






DIRECT MOUNTING

Three standard separable sockets for any thermometer in any range (see dimensions in drawing). Additional sockets may be purchased. Diagrams show how thermometers may be tilted and rotated.



REMOTE READING

DUCT THERMOMETERS

Duct thermometers are the Gas Filled type, used for the wide ranges required. They are standard with Marsh "Recalibrator." Both direct mounting and remote reading types, as illustrated here, are standard as follows:

Two sizes:

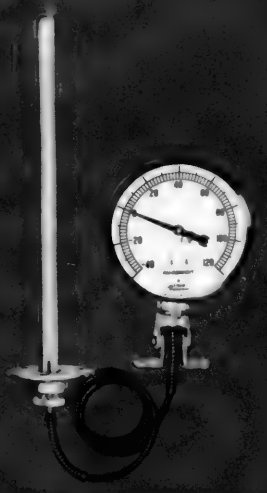
[illegible]" dial size.

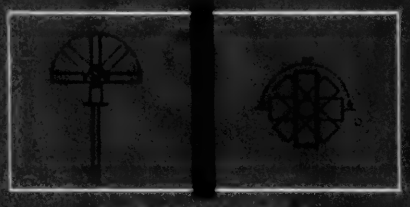
Three ranges:

[illegible] to plus 120° F
0° to 120° F
0° to 300° F

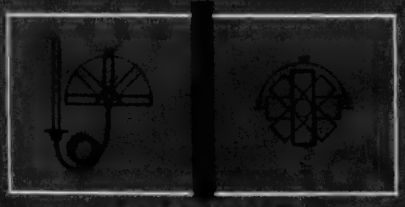
Two extension necks and stem lengths

[illegible] combination in any range from dimensions in drawing). Diagrams show how thermometers may be tilted and rotated.





DIRECT MOUNTING



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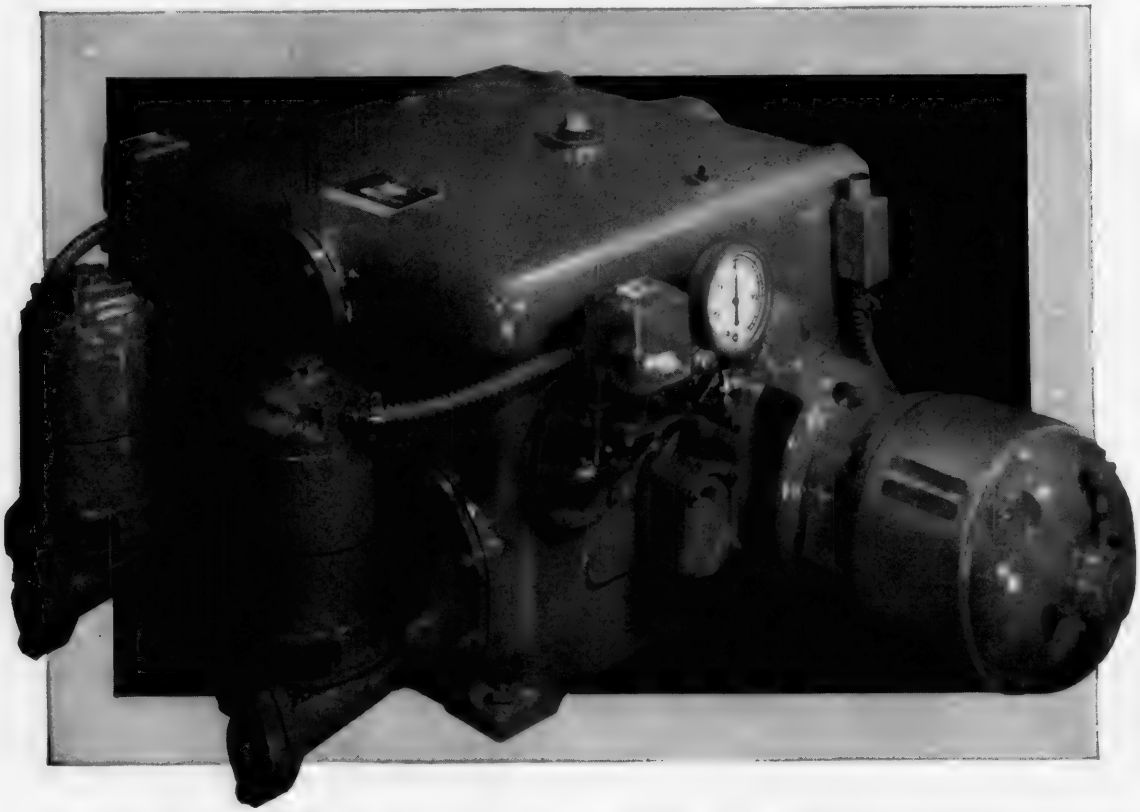

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Design Considerations for Central Station Air Source HEAT PUMP SYSTEMS

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Air Conditioning Division, Worthington Corporation
East Orange, N. J.

This article presents some of the problems which confront the designer of a central station heat pump system having an air source. The features of such a system differ considerably from those of small packaged type heat pumps, so that the latter are not considered in this study. The central station system of the air source type is studied from an economic point of view and a few basic cycles are reviewed.

HEAT PUMPS MUST BE CONSIDERED on their inherent merit. They should be competitive with any other heating system, such as coal-, oil-, gas-fired boilers, electric resistance heat, etc. In the writer's opinion, the following analysis presents the more important design factors which have to be evaluated in such a heat pump system, when ignoring advertising or promotional values associated with the supposed glamour of the heat pump.

A. *A heat pump installation is favored if a building requires cooling as well as heating.* Unless very special circumstances are present, it would be expensive to install a heat pump if no cooling is required. A possible definition of a heat pump is "the most economic utilization of air conditioning equipment to produce heat during the winter season without the addition of a boiler plant." It has been established that, as a general rule, a heating-to-cooling ratio of 0.7 should not be exceeded. This ratio is an arbitrary one and is a prime consideration in the colder climates. A heat pump also requires that proper insulation be used for standard construction.

B. *The climate in which the building is to be located is a matter of prime importance.* It is well known that as the outdoor temperature decreases, the coefficient of performance and the potential load carrying ability of the heat pump decreases. A much better coefficient of performance exists in a warmer climate, such as the Southern States, the Gulf States and the West Coast, whereas the Midwestern States show a relatively poor coefficient of performance and will require a much larger consumption of power for heating purposes, plus a larger size plant.

C. *Comparative rates of electricity and alternate fuels are important factors in determining whether a heat pump is economically justifiable.* Emphasis must be placed on these comparative local rates and it should not be arbitrarily stated that if the rate is less than 1¢ per kilowatt-hour a heat pump is feasible. The fuel or gas rate is as important as the electric rate in this determination. The cost of fuels depends on the location and the transportation problems, and only after a careful evaluation of all rates and efficiencies involved can an accurate comparision be established.

D. *Even if all previous items favor a heat pump, the type of building which is to be conditioned on a year-round basis will be of major importance in our evaluation.* A building suitable for heat pump application can be defined as a building with large interior loads. For example, an industrial plant with a heavy interior load of machinery, working on a 24-hour basis, would be an ideal project for a heat pump. On the other hand, an apartment house of the luxury type, with practically no interior zones, would be a

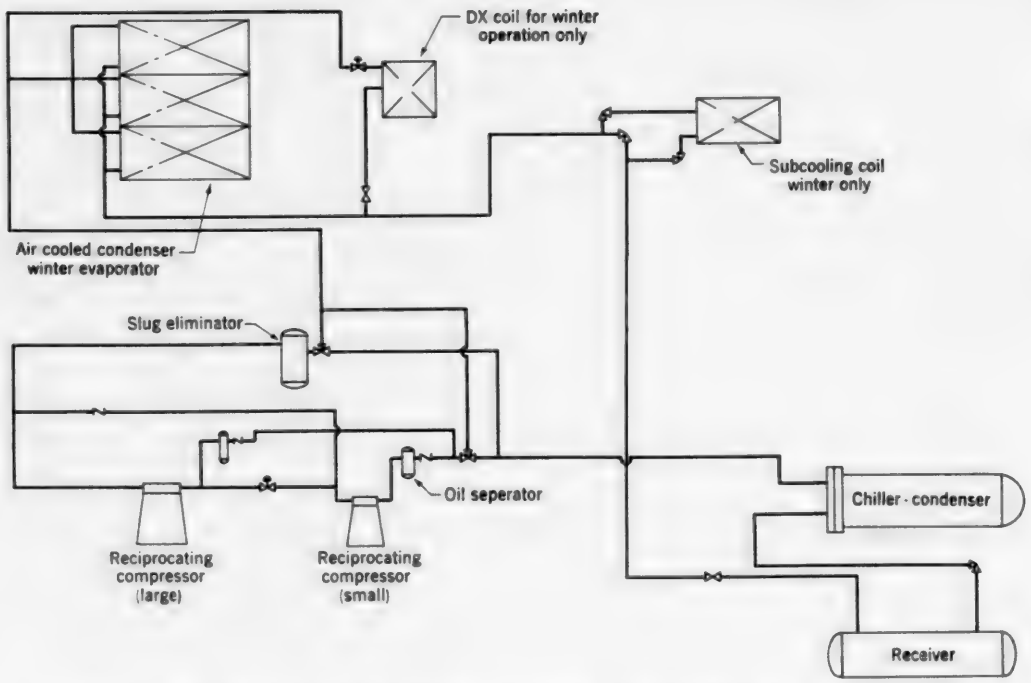

Fig. A. Flow diagram for air-to-water, two-stage reciprocating heat pump system.

poor application, due to the large transmission losses and the small interior heat gains. Climatic conditions enter into this picture, as the transmission losses depend on the outdoor temperatures. A building located in an area which experiences zero degree weather requires a very careful analysis, and normally a luxury apartment building, a hospital, or any other type of building with little or no interior load and large peripheral zones, is unsuitable for a heat pump. On the other hand, large office buildings, industrial plants, and other multizone buildings can, in many cases, be adapted to the heat pump application.

E. *Architectural considerations also play an important part in this tabulation and should not be overlooked.* A true air source heat pump will require outdoor coils, so that the heat can be absorbed from the outdoor air. In many instances the architect or the owner may not wish to install the machinery on the top floor of the building. In most cases the outdoor air handling equipment will have to be installed on the roof due to lack of space around the building. If the refrigeration equipment cannot be located on the roof, or on the floor below the roof, but in the basement, the height of the building may make a true air source heat pump impractical due to the long refrigerant piping runs which can jeopardize the efficiency of the performance. At present, five stories should limit the installation of equipment spread between the roof and the basement.

Load Requirements

Provided that the analysis of the above items has resulted in a favorable decision to go ahead with a heat pump system, the load requirements will have to be arrived at with unusual care. The summer load presents no special problem. It is the heating load which requires the attention when a heat pump is being considered. Most heating engineers have some axiomatic ways of arriving at the boiler horsepower required for a building or plant in a certain area. In most cases this boiler capacity is arrived at without either giving serious consideration to the air conditioning, heating and ventilating system or to the interior sources of heat. As a result of such calculations, the owner usually installs boilers of a capacity far beyond those actually required by the building. Such installations increase the capital expenditure of the project, and in many cases cause excessive operating expenditures during the years to come. If a heat pump is to be competitive and properly designed, the winter load should only be arrived at after a careful study of all internal heat gains and losses:

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A. *Exhaust air is one of the largest potential heat losses of any building.* It has been customary to compute the fresh air intake by multiplying the number of occupants by a certain CFM, or allowing a certain amount of fresh air per square foot. In the winter, the same amount of air is exhausted at room conditions. This will be exhausted even if the outdoor temperature is below zero degrees, without giving it a second thought. In an air source heat pump, if properly designed, a maximum of heat has to be recovered from this air before it is to be dumped. Many methods can be employed to achieve this result; for example, a coil can be installed in both the fresh air intake and the exhaust air discharge. The two coils can be connected with a pump, and an antifreeze solution can be pumped around the two coils. The recovery of heat, by means of cooling the exhaust air and preheating the fresh air, is very considerable at the expense of a very small horsepower required by the centrifugal pump. Millions of Btu's per hour can be recovered at the expense of 20 or 30 horsepower, a saving which cannot be achieved by fossil fuel fired boilers, electric resistance heat, or any other method. The exhaust air, after having been cooled from, let us say, 75 to 45 deg F, may then be dumped into the outdoor coils to raise the temperature of the outdoor air to provide for a slightly higher evaporating temperature. If no outdoor air coils are anticipated, additional recovery by means of straight refrigeration may be considered. Another method is the use of a rotary heat exchanger.

B. *Infiltration-exfiltration losses should be kept to a minimum because all air which enters and leaves the building must be conditioned in one way or another.* Infiltration and exfiltration cannot be conditioned and are therefore losses both in the summer and in the winter, and in a heat pump system such losses have to be controlled to a larger degree than in a normal air conditioning system. Windows and doors can be brought under the same category, and such items as revolving doors or air curtains should be given most careful consideration and may have to be excluded from the over-all building conditioning cycle.

C. *Recovery of heat from all other sources which may be available in the building should be evaluated.* Computers and other electrical machinery for office buildings, or industrial machinery if an industrial plant is being considered, are an important source of heat in a heat pump installation. Such machinery may provide a cooling load during the most severe winter condition. Such a cooling load provides a source of heat at a much higher temperature than the outdoor air and would therefore improve the coefficient of performance of any heat pump. Recovery of heat from waste water should also not be forgotten, as domestic water consumption in such a building or plant may be large and may provide an additional source of high potential heat.

Upon completion of the heat balance of the building, the winter load should be available in the following form:

Btu's required: during the day—occupied; during the night—unoccupied. These two values should be specified at various outdoor temperatures, and a graph plotted from the lowest winter design temperature to +60 deg. To obtain a clearer picture of what actually occurs, it is suggested that a line be drawn across the winter load graph showing the Btu loss at the average winter temperature. Only then will it be realized that a design at the lowest temperature may call for a very large Btu capacity, while the average temperature calls for a figure substantially below the one which you

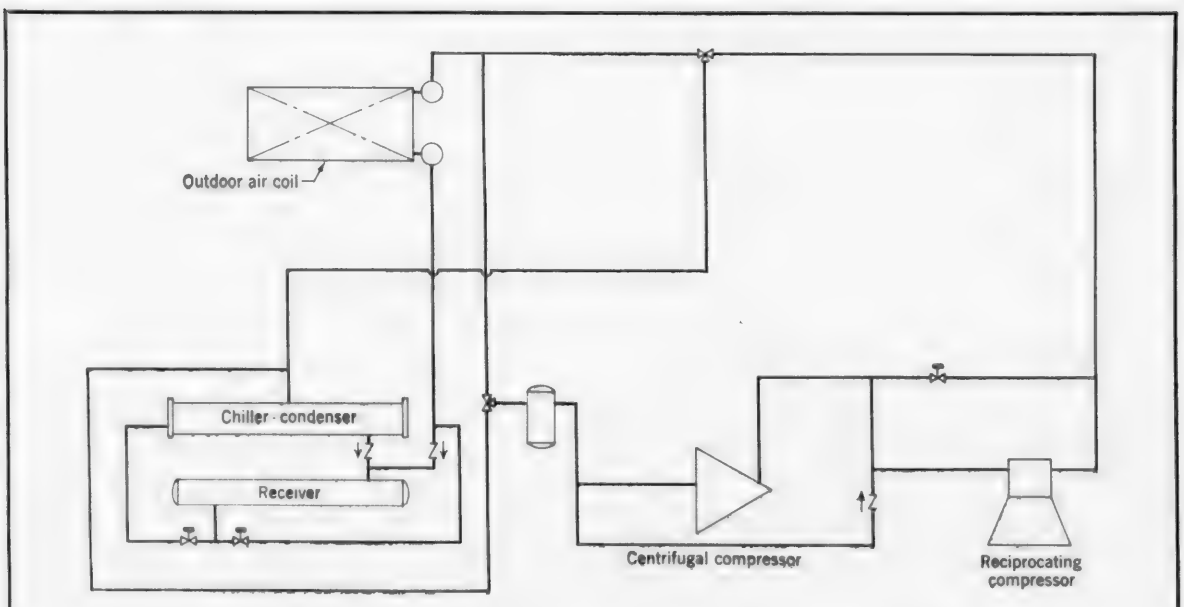

Fig. B. Flow diagram for centrifugal-reciprocating heat pump system.

may want to design for. The question arises if a compromise between these two requirements is possible.

Upon completion of the preliminary studies which have resulted in both cooling and heating loads, one is prepared to determine the type of equipment which will be required to meet these loads. The summer tonnage, in most cases, will indicate if the heat pump will require reciprocating or centrifugal compressors. For example, if the summer load is 150 tons centrifugal compressors cannot be considered if a heat pump is to be installed, since only Refrigerants 12 and 22 fulfill a heat pump's requirements of temperature and head conditions and no centrifugal of such small tonnage is economically available utilizing these refrigerants. The equipment selection cannot be quite as arbitrary since the type of heat pump being considered also plays a very important role in the equipment selection, and it is therefore imperative to discuss some of the fundamental heat pump cycles which can be applied. Some typical elementary cycles are shown in the system diagrams of Figures A, B, C and D.

Reciprocating System

System A illustrates a typical air source reciprocating heat pump in which the two reciprocating compressors have been selected for summer operation, to be able to provide a certain summer tonnage. The compressors are, however, not identical in size, so that in the winter the compressors can be staged to operate as a low temperature system to recover heat from the cold ambient atmosphere. It becomes apparent that the compressors can operate in the summer in parallel, during mild days in the winter in parallel, and during severe cold weather days in series. The rest of the equipment in this cycle consists of a chiller-condenser, a receiver, and outdoor air units. Auxiliary equipment, such as subcooling coils, additional interior direct expansion coils, and controls, can be incorporated as required. The cycle shown was selected on the basis of summer tonnage, which is the most economical heat pump selection. As the heat obtained from this cycle during the severe winter was insufficient to heat the entire building, additional electric resistance heat was provided as a booster to supplement the heat pump during the very cold days of the year. The cycle is essentially simple in nature and can be modified to meet many individual requirements for different types of buildings. The chiller-condenser shown in this particular cycle is of the direct expansion type. Flooded type chillers can also be provided.

The outdoor coils in this case are of the air cooled type. Advantages of the air cooled condenser include the close fin spacing giving substantial total heat transfer surface per square foot, as well as the elimination of any water sprays, water makeup, water treatment, etc. The disadvantages can be summed up in the higher head requirement for summer condensing due to the dependence of the condensing temperature on the dry bulb temperature of the am-

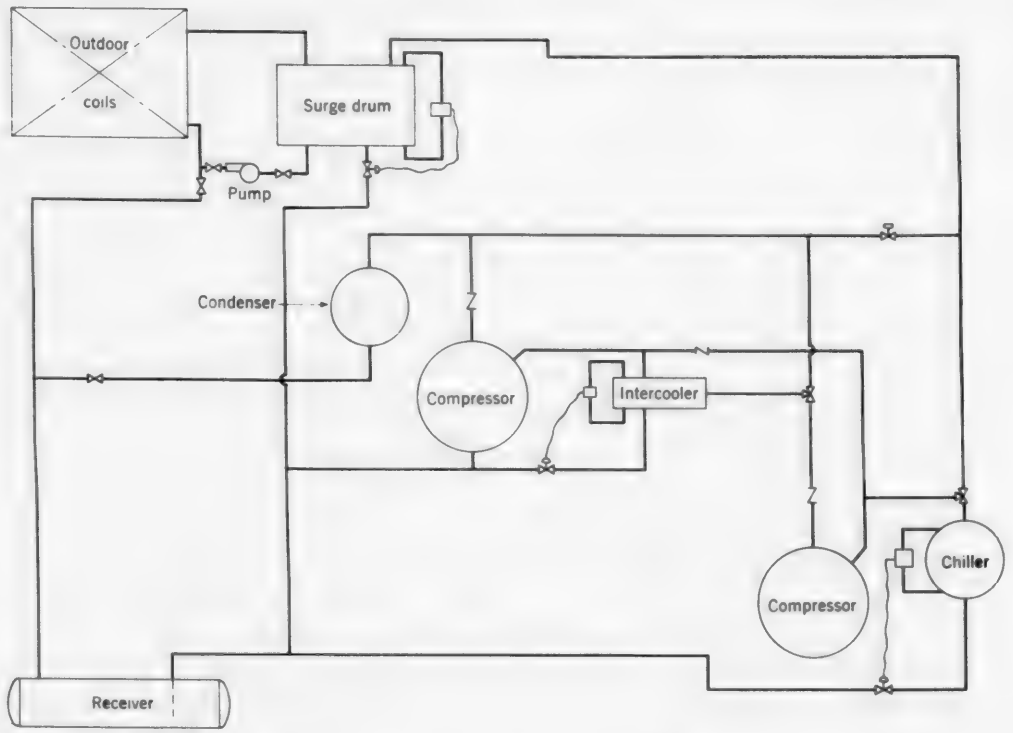

Fig. C. Flow diagram for air source, two-stage centrifugal heat pump system.

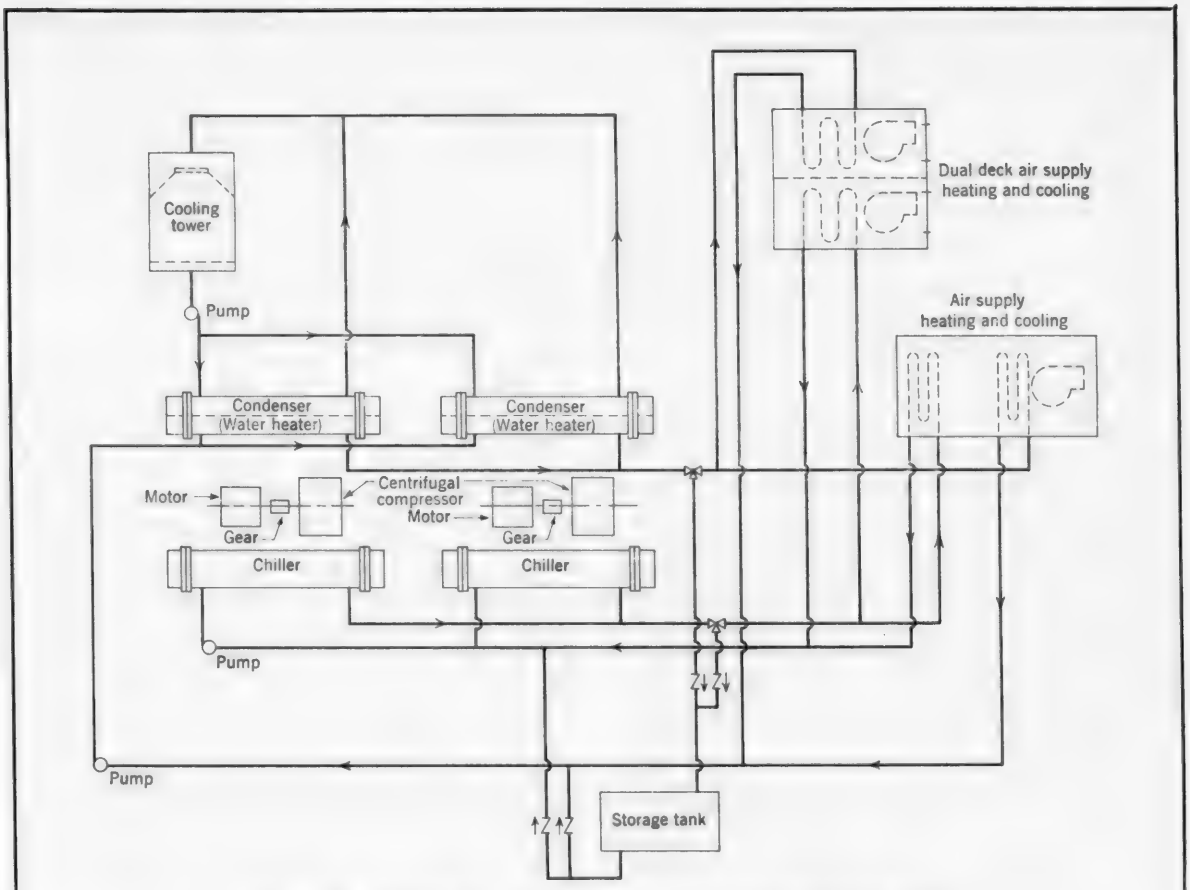

Fig. D. Flow diagram for centrifugal compressor—heat storage system.

bient. This high condensing temperature results in increased horsepower during the cooling season.

An evaporative type condenser can be employed in lieu of the air cooled condenser. The advantage here is the power saving due to the lower condensing pressure in the summer, which depends on the wet bulb temperature. A distinctive disadvantage is the water requirement, which can cause dirt problems, corrosion problems, and generally contribute to the complexity of a system due to automatic draining and refilling for a fully automatic heat pump. The problems are not insurmountable, but require additional automatic controls and, hence, servicing.

Both units—the air cooled condenser and the evaporative type condenser—can be supplied with head pressure controls for steady operation during the summer months.

Centrifugal-Reciprocating System

System B, which is a centrifugal-reciprocating application, is basically an outgrowth of the system described above. It is usually employed for larger tonnages, which would have to be handled by a large number of reciprocating compressors. This is particularly true in the winter, as the low temperature requirements result in rather large volumes of gas due to the low outdoor temperature and the consequent large specific volume of the gas. Centrifugal-reciprocating heat pumps can operate in a similar way as described; namely, in parallel in the summer, but seldom, if ever, in parallel in the winter due to the different heads pumped by the two compressors. Normally, the centrifugal is just employed as a booster during winter operation, and the reciprocating compressors as high stage compressors.

A major difficulty experienced in a system of this nature is a typical characteristic of a heat pump. It is the low heat capacity requirements at relatively cold outdoor temperatures during high occupancy of the building. It may be necessary to work two-stage, but only 10 or 15% of capacity, and this is a demand which is extremely difficult to fulfill with a centrifugal compressor when operating as a booster. The high-stage compressor, which is a reciprocating compressor, can easily be unloaded by eliminating the desired number of cylinders. The centrifugal, however, has to have a throttled suction or a change of guide vane position, and neither of these methods of capacity control unloads to such a high degree and fulfills the high head requirement simultaneously. These problems have to be faced by the compressor manufacturers, and multiple machines, of course, make the situation easier. It must be remembered that no hot gas bypass is permitted in such systems

as it results in fictitious loading and consequently in a waste of electrical power. Regardless of these difficulties, such systems are now operating in various parts of the United States.

Centrifugal System

The centrifugal heat pump of the air source type (see Fig. C) shows two centrifugal compressors which are operated in parallel in the summer. During the winter, the same two compressors can be used in parallel operation during the mild days and in series operation when two-staging is required. The system is basically not any different than the reciprocating heat pump, except that centrifugals have been substituted for the reciprocating equipment. To the writer's knowledge, no such heat pump system has yet been installed in the United States, and problems exist, due to the inherent characteristics of the compressors, which have not yet been solved.

These problems are primarily created by the mismatched design requirement of calling for more heating on colder days and less heating on warmer days, which is the exact opposite of the system's ability to perform. The colder the outdoor temperature, the less heat a heat pump can produce; the warmer the outdoor temperature, the more heat the heat pump can produce. It is, therefore, a question of capacity control, head control, and surge control which creates the obstacles to this type of a system. In many instances, the small amount of heat required during mild nights may prevent successful operation of such a system due to the difficulties of controlling large centrifugal equipment producing high heads with very small capacity.

A system of this nature would be most suitable for very large installations where multiple compressors for summer and winter operation would be required, and entire units could be shut down for capacity control operation.

Centrifugal-Heat Storage System

The fourth system (see Fig. D) is a heat pump, but its performance cannot meaningfully be compared with the normal reverse cycle heat pump. The writer suggests that a system of this nature be called a "heat conservation cycle," and not a heat pump, so that the two can be differentiated without confusing the layman. The heat conservation cycle has no outside air source and derives its heat output from two sources—the excessive heat of the interior zones of the building during the occupied periods, and the actual power input to the compressor motors. It is, therefore, extremely difficult to state that the system has a coefficient of performance since a coefficient of performance is usually associated with a heat source, such as outdoor air or water.

A coefficient of performance can be 3 or 4, depending on the temperature of the outdoor air or water source and the condensing temperature. With the heat conservation cycle and the elimination of the outdoor source, the cycle's output depends on interior heat sources during the occupied hours. It would therefore be misleading to state that such a system has a coefficient of performance, as such a coefficient would be compared on the basis of a reverse cycle heat pump, and this would be misleading since this coefficient of performance can only exist during certain hours of the day. During the majority of hours —namely, the 12 or 13 hours of unoccupied heating per day and during weekends—this system depends on the heat stored in the storage facilities and on the actual kilowatt input to the electric motors. This lack of external heat sources restricts this system for general use. However, in some cases a building will lend itself to its application, and the system does have some very attractive features.

This system is based on the fact that on most days an occupied building creates excessive heat during the day. This heat is absorbed by the chiller and any excess above and beyond the heating requirement is stored in a storage tank, thereby raising the temperature level of the storage tank during the day hours. At night, when the building is unoccupied, and heat losses exceed heat gains, load is supplied to the centrifugal (or reciprocating) chiller from the storage tank, and hot condenser water is circulated through the various heating coils to maintain the building at specified temperatures.

Which System to Use

Determining the most economical system is the key to the successful heat pump. An economical system must not only be competitive in operating cost, but consideration must also be given to pieces of equipment, their size, initial cost, life span, auxiliaries, reliability, and maintenance. It may be feasible that a reciprocating two-stage system will be a stand-off with the reciprocating storage system, as far as capital cost is concerned. The coefficient of performance of the reciprocating two-stage heat pump system, however, is much superior at low temperature to the heat storage system, whereas, on the other hand, the heat storage system may be a more reliable system than a two-stage system. Quantities of refrigerant, defrost, cycling, oil recovery, noise, and automation are all problems which have to be carefully considered. Actual total heat requirements per day, and per week, as well as per cold spell, may have to be estimated to arrive at realistic data, because a sudden cold snap lasting only six hours may, for a two-stage heat pump, require additional equipment which cannot be justified by any means.

This brings us to one of the most delicate problems in the heat pump field—the duty of the owner, architect, engineer and manufacturer. In many cases, owners have heard about heat pumps and have either approached the architect or engineer or, in some cases, even the manufacturer directly, requesting a heat pump for a certain project. There is no doubt that the proper approach, of course, is for the owner to retain a reputable consulting engineering firm. It is up to the consultant to analyze the project and advise the owner as to the suitability of a heat pump for his particular project. Such an analysis should be impartial, and if the project does not justify a heat pump, a conventional system should be used.

Where U-Values Can Mislead

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Where the building wall is other than straight and uniform, the U-factor value approach to heat transfer may not work. Herein are shown some areas which require special treatment.

Investigation by the Mechanical Engineering Department of the University of Utah into the problems of heat transfer encountered in large buildings have established definitely that the simplified methods (for example, the *U*-factor value approach) of estimating heat loss furnish incomplete and frequently erroneous results.

Shortcomings of the "approved" methods of calculation assume greater importance in view of increased size of buildings and some features of modern construction. Inexact calculation is not critical in case of a uniform wall or ceiling (for example in concrete or masonry design), but has to be watched by the designer in case of the typical curtain walls, glass walls, or complicated composite wall designs. It is hoped that the engineering data presented will be of direct help to the building industry in coping with the problems posed by modern building construction.

The generally practiced method of calculating heat loss (or gain) and of arriving at the approximate size of the heating and air-conditioning equipment consists of establishing the *U* value for any composite wall, so that the rate of heat flow through any wall section may be obtained by the formula:

$$q = UA\ (t_i - t_o)$$

where

q = heat transfer rate, Btu per hr,
U = overall transmission coefficient, Btu per (hr) (sq ft) (deg F difference between air temperatures on either side of wall), and
$(t_i - t_o)$ = air temperature difference, inside and outside, deg F.

Where the Method Fails

Let us point out the shortcomings of this method: First of all, the *U* value *does* include the effects of air film resistances. These are generally assumed to meet "standard" conditions. For example, no forced movement of air inside and 15 mph wind outside are frequently taken to meet typical condition requirements. The question arises: What if some unusual weather conditions exist? If there is a hurricane? If rapid circulation of air from the grilles impinges against the wall?

Results of our investigation confirm that it does not make much difference if we are dealing with a thick, well-insulated wall. However, if the above conditions arise in a wall construction containing through members—for example, projecting studs, structural steel or aluminum members with one face exposed to the outside and the other forming part of an inside face of the wall—then the actual *U* value may be over 400% larger than the calculated value for the "typical condition." This fact should alert the consulting engineer and the architect to some dangers inherent in the types of construction where these features occur.

Another, equally important, objection is perhaps more difficult to realize. Let us state the objection: It is incorrect to add the rates of heat transfer of adjoining sections of wall which have different *U* values to obtain the total value of the heat transfer rate. Indeed, we are assuming in the "standard" calculations that heat flow in a composite section proceeds only in the direction perpendicular to the wall's surface. Let us take an example, illustrated in Fig. 1, of a construction featuring a sudden change in the wall's thickness. The assumed direction of heat flow is indicated by arrows.

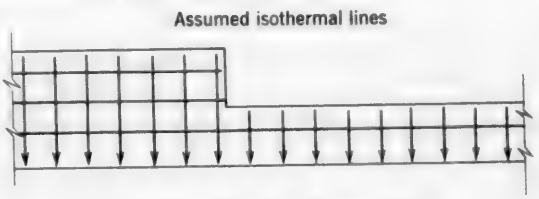

Fig. 1. In reality, the lines are bent.

Actual heat flow may look more like that in Fig. 2. The rate of heat transfer of the thicker section is greatly increased in the vicinity of the change in cross-section.

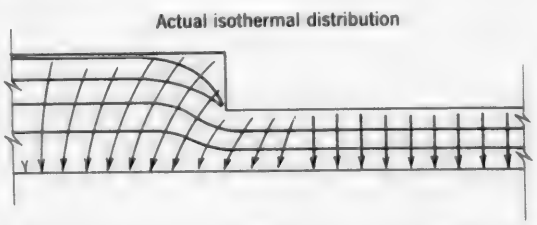

Fig. 2. U-values are not uniform for a non-uniform wall.

The effects of a change in material properties would be equivalent to retention of the same material with changing cross-sectional area. In both cases, a more exact approach to calculation of total heat transfer must be substituted for a summation of the products of cross-sectional areas and their respective U values.

To help the practical engineer quickly recognize whether or not the U-value approach may give a reasonably correct answer, let us present an evaluation of the expected error level (if the climatic conditions agree with the "typical values") for some frequently encountered configurations:

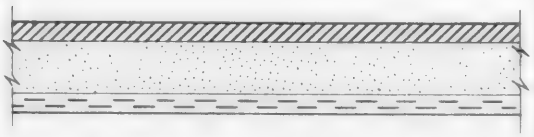

Fig. 3. With uniform wall, U-values are OK.

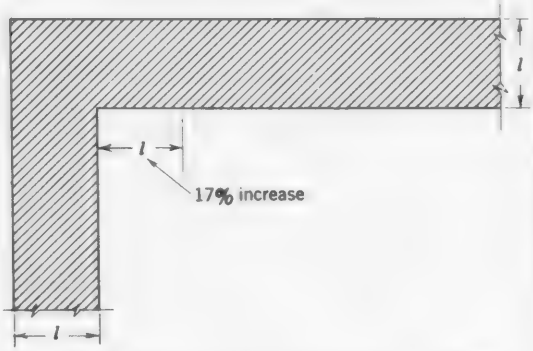

Fig. 4. In the corners, heat transfer jumps 17%.

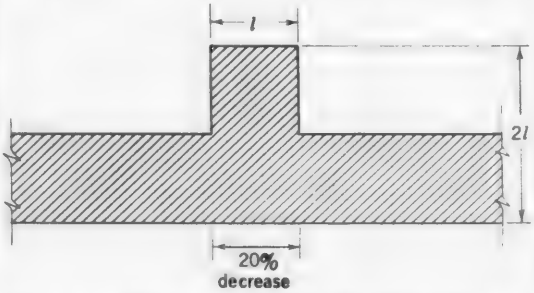

Fig. 5. Wall projects 100%, but decrease is only 20%.

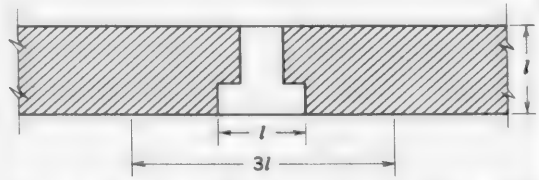

Fig. 6. Wall with aluminum member. Over length 3l, error may be over 100% if standard U-valves are used.

In Fig. 3, the case of uniform wall cross-section, there will be no error. In Fig. 4, illustrating a corner, an increase of 17% over the "standard" calculation value can be expected. In the case of a projection from the wall, as in Fig. 5, a decrease can be expected. (Note that doubling the thickness does not decrease the rate of heat flow by 50%, but only by approximately 20%, for this particular configuration.)

Results of "standard" calculation are completely incorrect over the length of $(3 \times l)$ as indicated in Fig. 6. The error may be easily in excess of 100% of the calculated value.

We cannot discuss here the various design features, but a general rule may be formed: Whenever a sudden change occurs in either the thermal properties of the material or in the cross-sectional area, it is wise to consider the need for more exact analysis.

More Exact Method Available

More exact methods of analysis are available to the engineer. These are:

(1) *Successive approximation techniques of numerical analysis.*

The results of relaxation techniques have been applied, for example, to establish the results quoted in Fig. 3, 4, 5 and 6. The technique is described in a number of textbooks (for example, *Relaxation Methods*, by Southwell). The method requires, however, specialized mathematical training.

(2) *Analogue measurements.*

This technique has been very extensively applied in our investigation, and may be easily applied by any engineer to analyze a truly complex configuration. The method is easy to understand, and an electrical circuit simulating a heat transfer situation may be erected at a cost of a few dollars. Moreover, once erected, it enables us to analyze the effects of design changes, unusual weather conditions, local insulation, etc. In addition, the technique is easily adapted for measurements of highly complex non-steady heat transfer phenomena, which may be important in determining optimum design.

Importance of Theoretical Findings

Savings possible in heating and air-conditioning are seldom realized, even by experienced designers, perhaps because the greatest part of these costs is hidden. Apart from operating costs and direct fuel bills, the designer would have to consider interest on a larger investment, additional taxes, insurance, wasted building space, depreciation, load problems, and noise suppression to arrive at the added costs of unnecessarily large heating and air-conditioning equipment. Indeed, some comparisons made during our study indicate that some startling savings might be achieved if more architects and engineers would fully consider the heat transfer features of their designs.

Reference

W. Komkov. *Heat Transfer in Large Buildings*, Univ. of Utah, Oct., 1960.

ESTIMATING

Here is the first of a new and factual series. Part 1 covers the budget and the detailed type estimate.

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SUCCESSFUL operation of a consulting engineering practice, or the work of a contractor, or the best interests of a client, is closely related to the preparation of an intelligent and correct estimate of what contemplated new work or alterations will cost. Apart from design, estimating is truly a field unto itself and requires a man with special talents.

While the term "estimate" is very embracive, basically there are two kinds of estimates and each will be discussed:

1. The detailed estimate used by the contractor in bidding for work, based on an engineer's drawings and specifications.

2. The budget price estimate prepared in an engineering office to give the client a close approximation of what his proposed work may cost.

Qualifications of an Estimator

What manner of man is a capable estimator and what should be his technical background? He must represent a combination of talents, some of which have been acquired as the result of many years of practical experience. He must have a research mind and exhibit a keen interest in new developments to keep abreast of his field.

It is necessary for the estimator to keep in constant touch with labor trends and the market pertaining to material costs. Such information helps assure that an estimate prepared for office use or for a client is the proper one.

The development of new industries brings with it new products and new requirements. That is why an interest in research is listed as a qualification for a good estimator. To help him, he has at his disposal articles in various technical or trade magazines and the literature that is distributed by manufacturers. These sources will bring him information not only on new equipment and materials, but also details regarding new techniques. Because of such help he is better able to evaluate installation costs.

Library Is Important

On the top of the list of things that an estimator must do is the establishment of an efficient and factual cost library. He should approach manufacturers of materials and equipment, or their representatives, for catalogs and price sheets of their respective lines. Periodic checks are required to keep current the price data that he has assembled.

He must be familiar with the building codes and regulations in the areas in which his firm operates.

The estimator must be familiar with the rules and regulations of the labor unions operating in the area where the work is to be done. If he is in the employ of a contractor, he must know the requirements regarding the use of men from his company and those in the local unions. He must know the number of hours per day the men are permitted to work, the hourly rate of payment for the area, the various employee benefits covered by the union contracts, and regulations covering, among other things, traveling time.

There is no substitute for practical experience. Therefore, the estimator should have served some time as a mechanic, foreman, superintendent, field engineer or a contractor. This field experience enables him to visualize conditions and results in a more realistic estimate. Truthfully, one must have had years of experience before he can get the "feel" of the business.

Cost Analysis

Since an estimator must, for his own protection, be a cost analyst, some knowledge of accounting is helpful. He is then better equipped to digest the various figures pertaining to the cost of doing business, and the relation of these figures to an estimate. As an example, for the contractor there are certain fixed charges for maintaining the home office such as rent, lighting, telephone and telegraph, mail, the purchase and maintenance of such equipment as threading and cutting machines, lathes, drill presses, and various small tools, the wages of office personnel, and other miscellaneous expenses.

Where a construction job is distant from the home base, the estimator must include the expense of housing for the field office and storage of materials, the cost of power, telephone, travel, salaries of field office personnel and miscellaneous items. Also to be considered are overhead expense which includes fire, employer's liability and public liability insurance, social security and unemployment taxes.

Stock Records

Knowledge of stock on hand is helpful. Stock piles have a tendency to increase very rapidly unless they are closely watched. After every job a certain amount of material will be returned to stock to be placed on racks and in specific bins. Unless a good inventory is maintained, such items can be forgotten and no correction made of the cost of material used. Stock is a financial investment and the more often it can be turned over, the greater is the profit that can be realized.

Waste of material must be avoided. On large projects, the mechanic has a habit of "losing" or "forgetting" to return left-over materials to stock. It is easier for him to do this than to carry the items back to the stock room. If not watched, such losses can be sizable and the losses can have an effect on the final cost analysis which the estimator should make at the completion of a job. Such studies are most important and the alert estimator uses these figures as a yardstick when preparing new estimates for the cost of proposed work.

Labor Records

Labor performance is an outstanding problem for the estimator. Should he have had field experience, he is aware of the pitfalls that may overtake a mechanic on the job. Where possible difficulties can be visualized in advance, allowances can be made to correct them.

A method should be established to apply labor costs that will give as consistent results as possible. Many can be used, including the application of labor to material on a percentage basis or a performance record based on the various phases of the work and the types of material used.

Many times, a foreman or superintendent for a contractor in making up his assignments for the day will send out his gangs and will note in his book the personnel that were assigned to the various gangs. Let us assume that later in the day, because of an emergency, it becomes necessary to take some of the men away from their first job and to reassign them to this special task so that some other trade would not be delayed in their work. Most likely no entry is made by the foreman in his book to show that there was a reassignment of men. No time charge is made for the emergency work; the office records are now distorted and the cost analysis is not accurate.

When proper material and labor cost information is supplied the office from the field, the estimator is able to judge whether the project is running in line with his original computations.

Once a good set of figures is compiled, it can be checked against jobs that may follow, until very dependable weighted average man-hour performance records are available for use.

Budget Estimates

Up to now, only the contractor was considered. Attention should now be directed to the estimator who is employed by a consulting engineer or an architect. Consultants, acting as representatives of the owners, are required to make many types of estimates during the life of a project.

Robert J. Smith received a B. S. in Mechanical Engineering degree from Columbia University. He has had wide experience in the construction field, having served as a designer, field engineer, cost engineer and estimator on industrial and utility projects. During this period he was associated with the following firms: Ford, Bacon & Davis; Jackson and Moreland; Burns & Roe, and Ebasco Services. He was engaged in the plumbing and heating business for over ten years as a licensed contractor. He is now doing mechanical estimating for Voorhees, Walker, Smith, Smith and Haynes, N.Y.C.

The first to require attention is the budget or preliminary estimate based on the tentative design of the contemplated project. This type of estimate is prepared in conjunction with the engineering and executive groups of an office. They are based on preliminary sketches or drawings so that when these first drawings are presented to the client, he will have some concept of the contemplated design and the cost of the proposed project. These figures are termed budget estimates and they are based on the costs of comparable projects that have been adjusted to meet conditions introduced by the factors of a particular area and time.

As the design progresses, there may be changes which will change the design from its original concept. These changes may be dictated by any or all of the following reasons:

1. Increase in efficiency of respective mechanical systems.
2. Improvements in appearance.
3. Reduction in cost of project.

An estimate must then be made of the cost of the change so that the client can decide whether the changes should become part of the final design.

When the working drawings have reached the stage where they may be considered as practically complete, a check or intermediate estimate is prepared. This estimate, which is fully detailed, is prepared to show the monetary effect of the changes in design.

After the drawings are completed, and all the specifications written, contractors are called in to make their estimates and submit their bids.

The estimator is still not through with the project. He is required to make a detailed estimate based on the final plans and specifications. He may do this by revising his intermediate estimate or he may re-estimate the entire job. When completed, this estimate should be in a competitive position with the bid submitted by a contractor. This is very important, for with this information before him, the estimator can guide the client in deciding which of the bids submitted are in the best interest of the client so that the proper award may be made.

The next article in this series will cover office forms to be used for recording information for the estimator.

Outside Air at Minimum Cost

Last month the author showed how his Air Mixture Chart can be used to enable the air conditioning engineer to visualize the consequences—of various control schemes adopted—on the economy of outside-air utilization. In this concluding section, six more methods of control of outside air for interior-zone ventilation are charted and compared.

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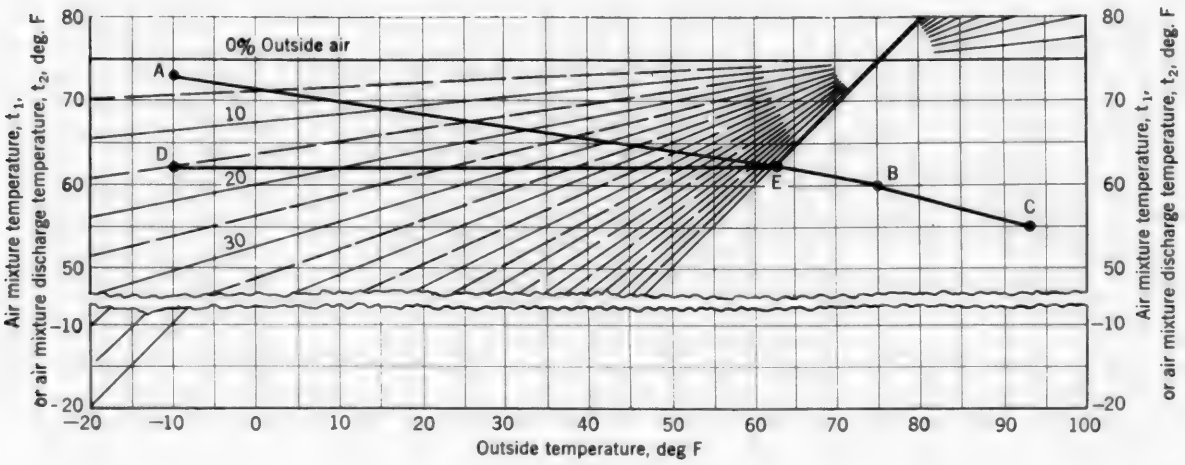


Fig. 4. The basic air mixture chart, with line ABC characteristic of the conditioned space, is the same as in Fig. 1, last month. From D to E, mixed-air temperature is held constant. As outside temperature rises further, 100% outside air is used. Cooling is required to maintain space at 75 F.

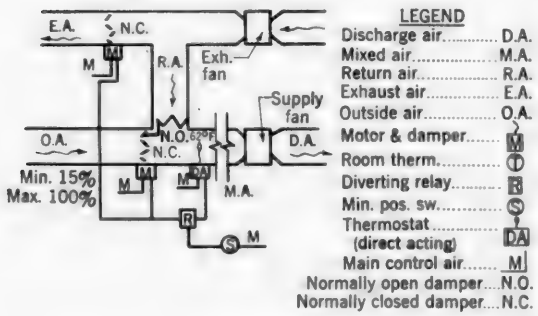


Fig. 4a. Diagram for controlling outside-air rate from mixed-air temperature. Result is shown on chart above.

3. Outside Air Controlled from Mixed Air

Figure 4 illustrates what happens when the temperature of the outside air is controlled from the mixed air. A minimum outside air positioning switch works in conjunction with the mixed air thermostat to prevent outside air from dampering below a predetermined minimum. (See Fig. 4a for the control layout.) The control thermostat setting must, of course, be predetermined. The 62 deg setting given is based on making the greatest use of outside air. This choice requires apparatus heating between the outside temperatures of —10 and 62 deg; apparatus cooling occurs above 62 deg. The minimum positioning switch takes command below —10 deg. Other control temperatures can be readily plotted with whatever minimum outside air percentages are desired. The mixed-air control arrangements as given do not minimize the outside air during the summer. Therefore, excessive apparatus cooling loads occur at that time.

* Operated for the United States Atomic Energy Commission by the General Electric Company.

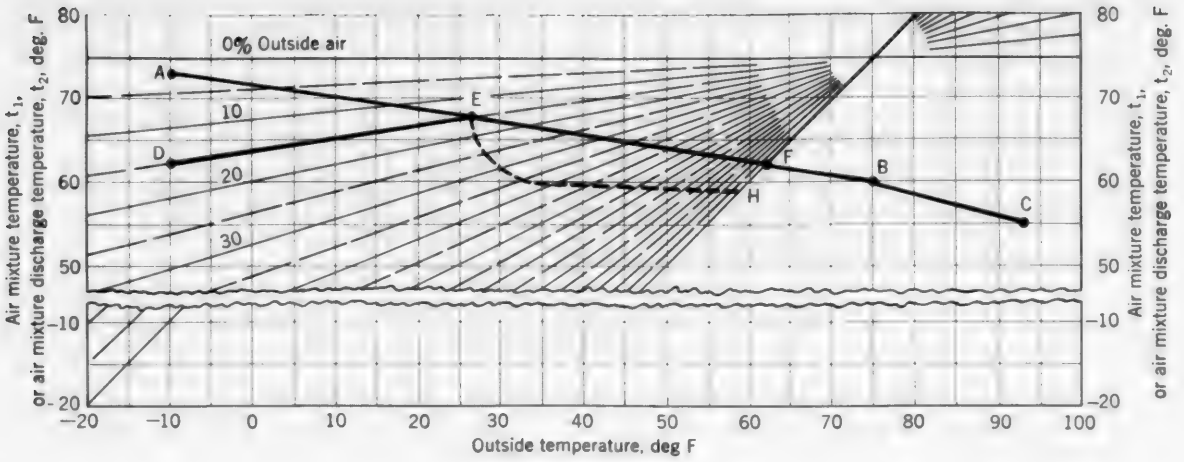


Fig. 5. When the admixture of outside air is carefully controlled by the outside-air temperature, heating and cooling are held to a minimum, as shown by the relative coincidence of ABC and DEFG. (The point G, not shown, lies on the heavy line, directly above C.)

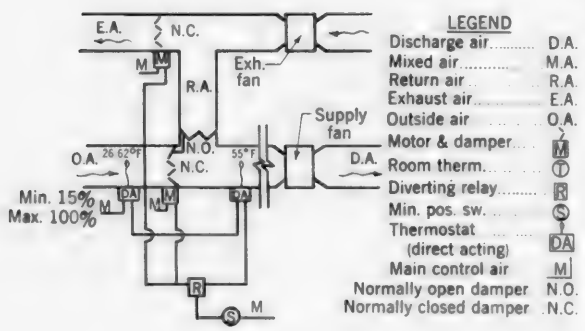


Fig. 5a. Diagram of control from outside air. Thermostat in mixed air takes over control when thermostatic control in outside-air stream is inadequate, preventing cooling or heating apparatus freeze-up.

4. Outside Air Controlled from Outside Air

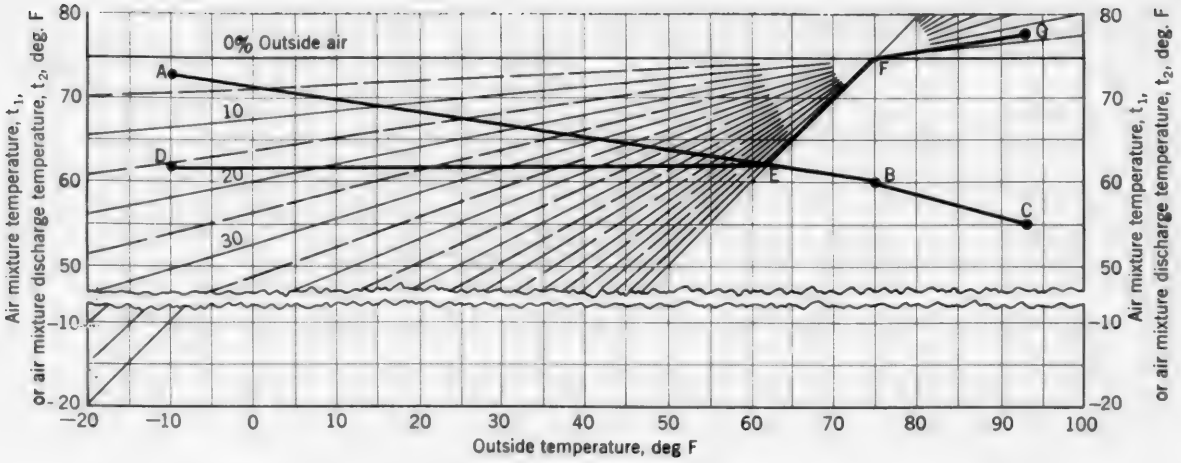
This method of control is an attempt to minimize unnecessary apparatus cooling, particularly characteristic of methods 1 and 2. However, it calls for careful adjustment of the outside air controller. Unless proper adjustments are made, the method is ineffective and may end up controlling from the mixed air, for reasons explained below. An ideal control situation employing this method is shown in Fig. 5, where the control response is described by solid line *DEFG*. This coincides with space-requirements line *ABC* in the range *EF*, where no apparatus cooling or heating occurs. In actual practice, the control may follow broken line *EHF* rather than solid line *EF*, thus falling somewhat below the latter line. Higher percentages of outside air intake than necessary result from this situation.

There are two reasons why controlling from outside air may become ineffective:

(a) Adjustments of the outside air controller, throttling from 26 to 62 deg outside temperature, are not easily made and in the past have not been readily determined. As a result, time-consuming trial-and-error field adjustments have been necessary. Such adjustments have not always been satisfactory from the standpoint of economical operation. Apparatus cooling or heating sometimes occurred in the *EF* range because of inappropriate control.

(b) In addition to the complications arising from the need for critical adjustment of the outside-air controller, the flow of outside air does not necessarily correspond to the action of the controller. Since the outside-air damper is gradually opened, the rate of outside-air flow can be greater than that corresponding to the per cent of damper opening. With a parallel-blade-type damper, flow of outside air may be as high as 100% of maximum when the damper is open as little as 25%, depending upon design air velocities. An opposed-blade-type damper gives better direction and flow characteristics.

Unless proper adjustments can be made and a straightline relationship between control action and actual outside-air flow established, space requirements within the limits of and described by line *EF* will not be met. A safety low-limit controller, located in the mixed air, is required to take over the control in case of abnormal outside-air control response. See Fig. 5a. Otherwise, there may be a risk of freezing up the cooling or heating apparatus.



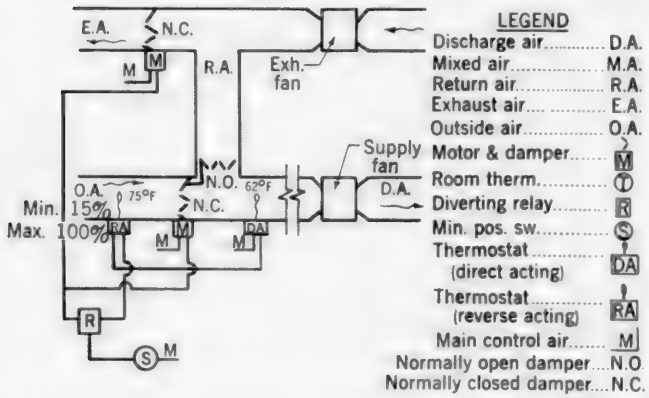


Fig. 6. Control sequence, where outside air is controlled from mixed-air temperature with outside air minimized in winter and summer, is shown on air mixture chart.

Fig. 6a. Diagram of control. Direct-acting thermostat controls from mixed-air temperature, but reverse-acting thermostat in outside-air stream takes over to minimize entrance of very warm or very cold outside air.

5. Outside Air Controlled from Mixed Air Minimum Outside Air During Summer and Winter

This method of control is similar to method 3, except that an additional controller is utilized. To minimize the outside air during the summer in order to reduce the apparatus cooling load at that time, the controller is located in the outside-air duct. Here the control pressure is reduced on a rise in temperature above the setting of the controller until the minimum positioning switch takes command of the outside-air position. See Fig. 6 and 6a.

6. Outside Air Controlled from Outside Air Minimum Outside Air During Summer and Winter

This method is a combination of methods 4 and 5 shown on Figures 5, 6, 5a and 6a. Outside temperatures above 75 deg are considered summer, and those below 75 deg, winter.

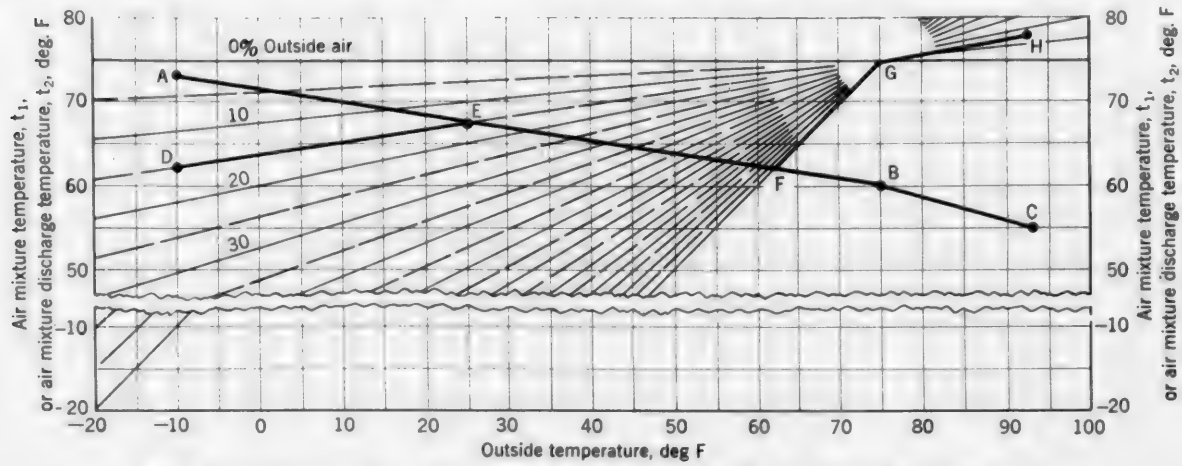


Fig. 7. Control response, where outside air is controlled from a room thermostat and outside air is minimized during summer and winter, is shown on air mixture chart. No cooling or heating is required between E and F.

7. Outside Air Controlled from Room Thermostat Minimizing Outside Air During the Summer and Winter

Figures 7 and 7a show the control response and control diagram, respectively. Space requirements outlined by line *ABC* in Fig. 7 are most closely satisfied, since the minimum outside air of 15% is maintained during the winter (line *DE*) and in summer (line *GH*). Otherwise, 100% outside air is introduced along line *FG*, in which case apparatus cooling is minimized as it is along *GH*. Damper action alone in direct response to room requirements is sufficient to control the air temperature in the space, between the outside temperatures of 26 and 62 deg (line *EF*).

The air mixture thermostat serves to prevent a sudden drop in mixed-air temperature in case of readjustment of the room thermostat. The summer controller is adjusted to 75 deg in order to match the requirements of Fig. 7.

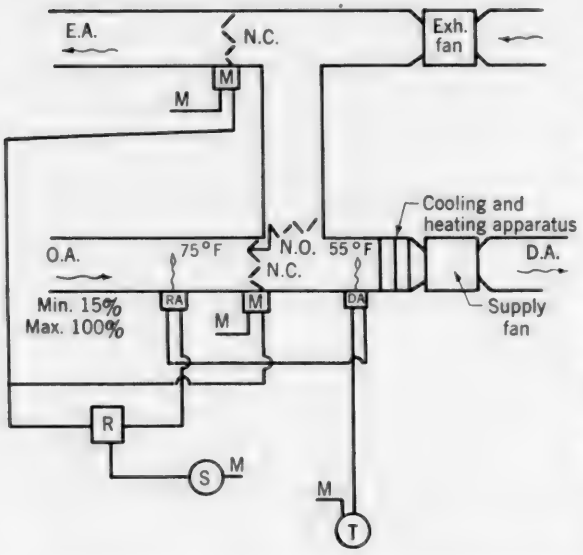


Fig. 7a. Diagram shows room thermostat in control, with thermostats in mixed-air and outside-air streams modifying its function. (For meaning of symbols, see Fig. 6a.) Results are seen in line DEFGH of Fig. 7.

8. Outside Air Controlled from Room Thermostat, Minimizing Outside Air During the Summer and Winter and Incorporating Operational Safety Features

Figure 8 is a diagram of a control layout which makes the most of outside air and incorporates operational safeguards to prevent damage to the equipment in case of control failure. Otherwise, the control sequence is similar to that in Fig. 7.

Features include thermostat *T2*, which prevents the minimum positioning switch from lowering the mixed air temperature below 55 deg in case the switch has been adjusted too high. If the mixed air temperatures drop to 40 deg, *T4* shuts the fan off and the outside-air damper closes, requiring manual restarting. Thermostat *T3* serves as a low limit, in case the room thermostat setting is readjusted to a lower temperature.

Conclusion

Of the eight methods of introducing outside air, methods 3, 5, 7 and 8 are preferred over the others, since they offer direct control of outside air. In each case, a mixed-air thermostat or room thermostat is in positive control of the resulting air temperatures. In those cases where control is from the outside air there is little assurance that proper temperatures will be realized, since the results depend on very exacting adjustment of the controls and the particular action of the damper design.

A final selection of the controls can be readily made by plotting the actual requirements according to the charting technique illustrated. This should assure outside air at minimum cost.

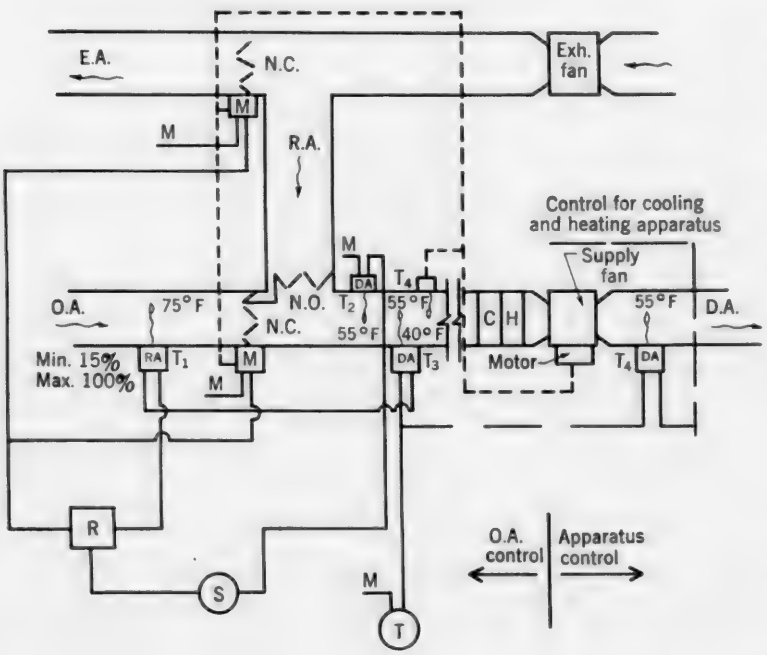


Fig. 8. Control layout that makes the most of outside air, yet includes safeguards against damage to equipment in case of control failure. See Fig. 6a for meaning of symbols.

ASH HANDLING

in commercial and industrial plants

AIR CONDITIONING, HEATING AND VENTILATING'S REFERENCE SECTION

This Reference Section is presented through the cooperation of and by special arrangement with the National Coal Association. It was prepared by the Association's engineering staff in collaboration with manufacturers of ash-handling equipment and fuel engineers in the coal and railroad industries, and will appear shortly as a bulletin of the Association as part of its Fuel Engineering Data series.

ASH is the noncombustible or inert mineral matter that remains after coal is burned. In this discussion of ash-handling methods, *ash* refers to the refuse of the coal-burning process. It includes the mineral constituent of coal as well as a small percentage of unburned carbon resulting from incomplete combustion of coal.

Amount of Ash Produced

For most design purposes it is satisfactory to assume that 10% of the coal fired enters the ash pit as refuse and must be removed by the ash-handling system. This assumption takes into account the small amount of unburned carbon (a maximum of 2.5% of the fixed carbon) normally found in the ash pit. Where the ash content of coal exceeds 8%, the assumed discharge percentage must be raised accordingly. It is also assumed that 1 lb of coal generates 10 lb of steam. Many plants exceed this record, however, so exact generation figures should be used, if possible, in design work.

Table 1 lists the amount of ash that must be removed weekly from plants ranging in capacity from 5,000 to 100,000 lb steam per hr, when operating one or two 8-hr shifts per day, 5 days a week. For example, a 50,000 lb per hr steam plant operating one shift at full load 5 days a week will accumulate 10 tons of ash; or 20 tons operating two shifts.

Sizing Equipment

Normally, design of ash-handling systems provides capacity for ash removal from boiler ash pits to ash storage once every 8-hr shift, and from the ash storage silo or bin at least once a week.

This is not a hard and fast rule, however. Considerable latitude is permissible in sizing ash-handling equipment. Systems of smaller capacity mean lower first cost and longer operating time per shift to remove accumulation, with consequent greater wear. Larger systems mean higher first cost, less operating time per shift, and less wear of equipment components. Considerable judgment is required to size ash-handling equipment to achieve lowest annual owning and operating costs, especially in plants of smaller capacity.

Specifying Ash-Handling Equipment

The layout of components of an ash-handling system must be tailored to each plant. It is good practice to have preliminary plans checked by a reliable ash-handling equipment manufacturer. The manufacturer's experience in laying out his own equipment will enable him to suggest many economies. When a decision has been made on the type of system best suited to the plant, specifications should be written so as to avoid two common pitfalls: (1) a hybrid specification in which components of different manufacturers are called for; and (2) an overly detailed specification that limits the discretionary latitude of the manufacturer in meeting plant requirements. In the first case the bidder is wary of components that are not to his standard and will increase his estimates to cover contingencies. In the second case he is restrained from incorporating economies in his proposal to meet plant requirements at a lower cost.

Ash Utilization

In many areas ash is sold to manufacturers of cinder blocks and to builders for use as fill. Slag tapped from pulverized coal fired plants is now used extensively as an aggregate for bituminous road surfacing and for coating roof shingles. Fly ash, which has pozzolanic properties, is being used increasingly as a substitute for 10 to 15% of the cement used in large construction projects. When fly ash and small portions of lime are mixed with earth or gravel and compacted, the mixture sets hard and produces an excellent base for bituminous surfacing. Some plants have installed special facilities to bag and grade fly ash as a convenience to the construction industry.

TABLE 1.—ASH ACCUMULATION

Design Full Load, Lb. Steam per Hr	Coal Use, Lb per Hr	Ash Produced		
		Lb per Hr	Tons per 8-Hr Shift	Tons per 5-Day Week, One Shift*
100,000	10,000	1,000	4	20
75,000	7,500	750	3	15
50,000	5,000	500	2	10
25,000	2,500	250	1	5
20,000	2,000	200	0.8	4
10,000	1,000	100	0.4	2
5,000	500	50	0.2	1

* The production of ash per 5 day week with two shifts is double that given in this column.

PNEUMATIC ASH-HANDLING SYSTEMS

In pneumatic ash-handling systems an air stream induced by a mechanical, steam or water exhauster transports ash from boiler ash hoppers and fly ash from dust collectors and traps to an elevated silo or ground-level bin. Such systems are characterized by great versatility in design. System layouts are not inhibited by architectural features, are relatively low in first cost, and can carry ash long distances horizontally and vertically. Pneumatic ash-handling systems range in size from those suitable for smaller commercial heating plants to those for large utilities.

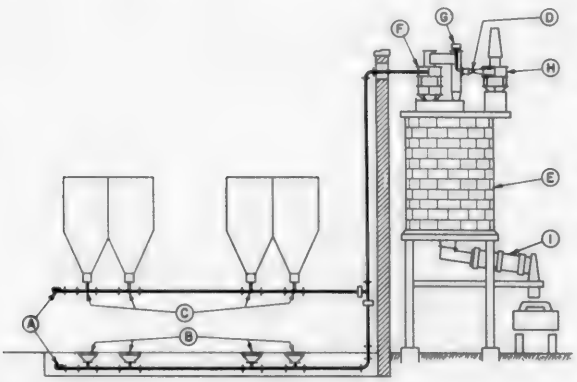


Fig. 1. Sketch of standard pneumatic ash-handling system: A, air intake; B, ash intake; C, fly-ash intake; D, steam exhauster unit; E, tile ash-storage silo; F, primary separator; G, secondary separator; H, air washer; and I, ash conditioner.

The steam or mechanical pneumatic ash-handling system for commercial and industrial plants is low in first cost and maintenance. The standard pneumatic system (Fig. 1) is usually installed in plants with a full load capacity of over 50,000 lb of steam per hr.

Components of a pneumatic ash-handling system can be standardized, but layout or arrangement cannot. Each plant has its own conditions, determined by plant location, equipment design and layout, to which the system must be adapted. The variety of systems makes it impossible to relate the capacity of a plant to the cost of a suitable ash-handling system. The one rough generalization that can be made is: Capacity of a minimum standard system is 6 to 9 tons per hr, and the cost is $10,000 to $12,000.

For plants with capacities of less than 50,000 lb of steam per hr, the cost of a pneumatic ash-handling system can be reduced by simplifying the standard system. For example, where no fly ash is handled, a ground-level storage bin of cinder block or other inexpensive construction may be used in place of an elevated silo, and a target box instead of primary and secondary cyclone separators. Fig 2 illustrates such a simplification. Other parts of the system are

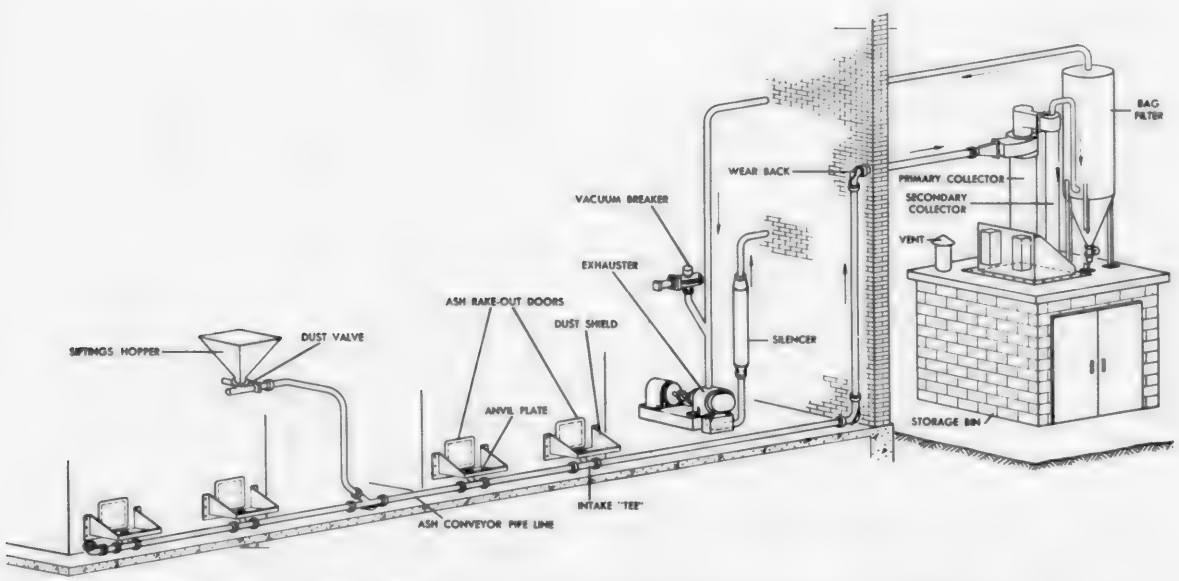


Fig. 2. Elevated silo of the standard system has been replaced by ground-level cinder block storage bin. Stored ash is removed by front-end loader to final disposal.

sized accordingly and are similar in design to standard system parts. Other simplified systems are shown in Figs. 3, 4 and 5.

Fig. 6 shows a 5-ton ash silo, a component of the system illustrated in Fig. 5. This silo with supports costs about $2,500. Note the cleanliness of the general area.

Simplified pneumatic ash-handling systems are available for plants handling 2 to 10 tons per day. They cost approximately $5,800, exclusive of freight and storage bin, or about one-third to one-half the price of a standard pneumatic system.

A standard specification for a pneumatic ash-handling system for a smaller installation is given in this month's blue Reference Data Sheet.

Relative Costs of Components

A rough guide to the relative costs of material and freight for components of a standard pneumatic ash-handling system is:

Piping and fittings	20%
Exhaust assembly	40%
Storage silo	30%
Discharge gate	10%
Total	100%

Installation costs must be added to these material and freight costs. Installation costs are roughly half as much as the material and freight costs for small installations, and about 35% as much for larger installations. Table 2 compares typical costs for a standard and simplified system.

TABLE 2.—TYPICAL COSTS FOR PNEUMATIC SYSTEMS

Item	Standard Installation	Simplified Installation	
		Mechanical Exhauster	Steam Exhauster
Exhauster	$ 1,100	$1,900	$1,050
Silo	8,385 (a)	2,935 (b)	600 (c)
Piping	1,900	660	660
Ash intakes	500	190	190
Freight	800	300	200
	$12,685	$5,985	$2,700
Erection	6,500	1,500	1,450
	$19,185	$7,485	$4,150
Cost index	100	41	22

(a) Includes $3,000 for cyclone collectors, filter and appurtenances; $4,660 for steel and tile for 20-ton ash storage silo; and $725 for discharge gate and spray.
(b) Collectors, filter and appurtenances, but excluding storage bin.
(c) Target box and appurtenances, but excluding storage bin.

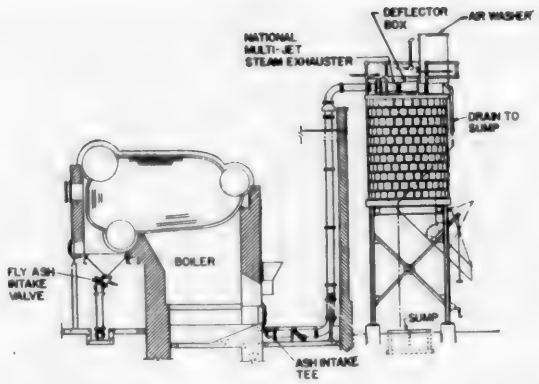


Fig. 3. Pneumatic ash-handling system (capacity of 5 to 15 tons per hr) for use with underfeed or traveling grate stokers. Fly ash has low dust content.

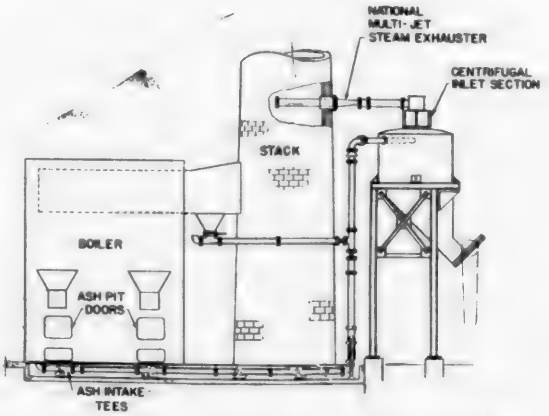


Fig. 4. Pneumatic ash-handling system suitable for spreader and pulverized coal fired boilers. Fly ash has high dust content.

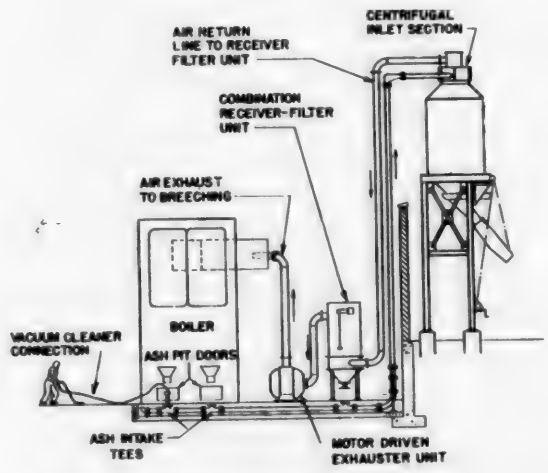


Fig. 5. Pneumatic ash-handling system for low pressure steam heating plants. Vacuum is induced by motor-driven exhauster unit.

Capacities

It is generally considered good engineering practice to install a system that will remove ash accumulated during an 8-hr period of operation at full power in one hour or less. This, however, is not a hard and fast rule. In large plants there may be economic advantages in operating a system for longer periods. Ash-handling systems are rugged and can be sized for operating periods that, in the judgment of the consulting engineer and manufacturer, will best meet the requirements of a particular plant.

Conveyor piping usually supplied for medium or large-size pneumatic systems is either 6- or 8-inch diameter. Use of 4-inch diameter piping for other than branch lines for fly ash or siftings is normally not recommended except in smaller installations. If ash must be hoed to the intake and clinker breaking is required, the capacity of the 6-inch system is 5 tons per hr, and the capacity of the 8-inch system is 8 tons per hr. With a normal type of ash and a minimum of hoeing and clinker breaking, the capacities of the two systems are 8 tons and 14 tons per hr, respectively.

With free-flowing ash and fly ash and gravity discharge to the intake hopper, maximum capacities are 14 tons and 20 tons per hr, respectively.

The maximum-size clinker that can be handled by the 6-inch system passes through a grid with 3-inch square openings; the maximum size handled by the 8-inch system passes through a grid with 4-inch square openings. Clinker size rather than the hourly capacity of the system will govern system size in plants where large clinkers are common.

Fig. 6. Five-ton capacity steel ash storage silo installed in apartment house area.

Ash Intakes

Fig. 7 shows typical ash hoppers used with various types of stokers and typical design of bottom-ash receivers for ash-handling systems. Ash pits and fly ash hoppers should have storage capacity for at least an 8-hr accumulation. Greater storage capacity permits even more flexible ash removal schedules.

In *A*, *B* and *D* of Fig. 7, bottom ash is admitted into the main conveying lines by removing the cast-iron plug with a lifting hook. In *C* (Fig. 7) the intake fitting is equipped with a piston-operated slide valve activated by automatic controls. In some cases receivers are fitted with manually operated slide valves.

The ash pit hopper shown in A (Fig. 7) provides complete gravity discharge, which speeds ash removal and minimizes manual effort on the operator's part. In *B*, space does not permit a deep gravity-flow hopper. Here the design provides large storage capacity, which requires more manual effort and thus increases the time required to empty the hopper.

A typical ash hopper arrangement for a spreader stoker with traveling grate is shown in *C*. The arrangement is of special interest. The design enables the operator to handle ashes without leaving the firing aisle. The entire ash-handling operation can be accomplished from a station at the boiler front with the aid of automatically operated valves at the fly ash hopper discharges. In plants where operators are not permitted to leave the firing aisle, such an arrangement allows one man to carry out the entire boiler operation procedure.

A typical arrangement with single retort underfeed stokers or in plants where elevations do not permit deep ash hoppers is shown in *D*. More manual labor is required for ash removal in this case, but even with minimum space under the boiler, pneumatic systems can be designed to handle ash conveniently, cleanly and economically.

Intake valves at fly ash collecting hoppers are operated manually through a pull rod or a chain-

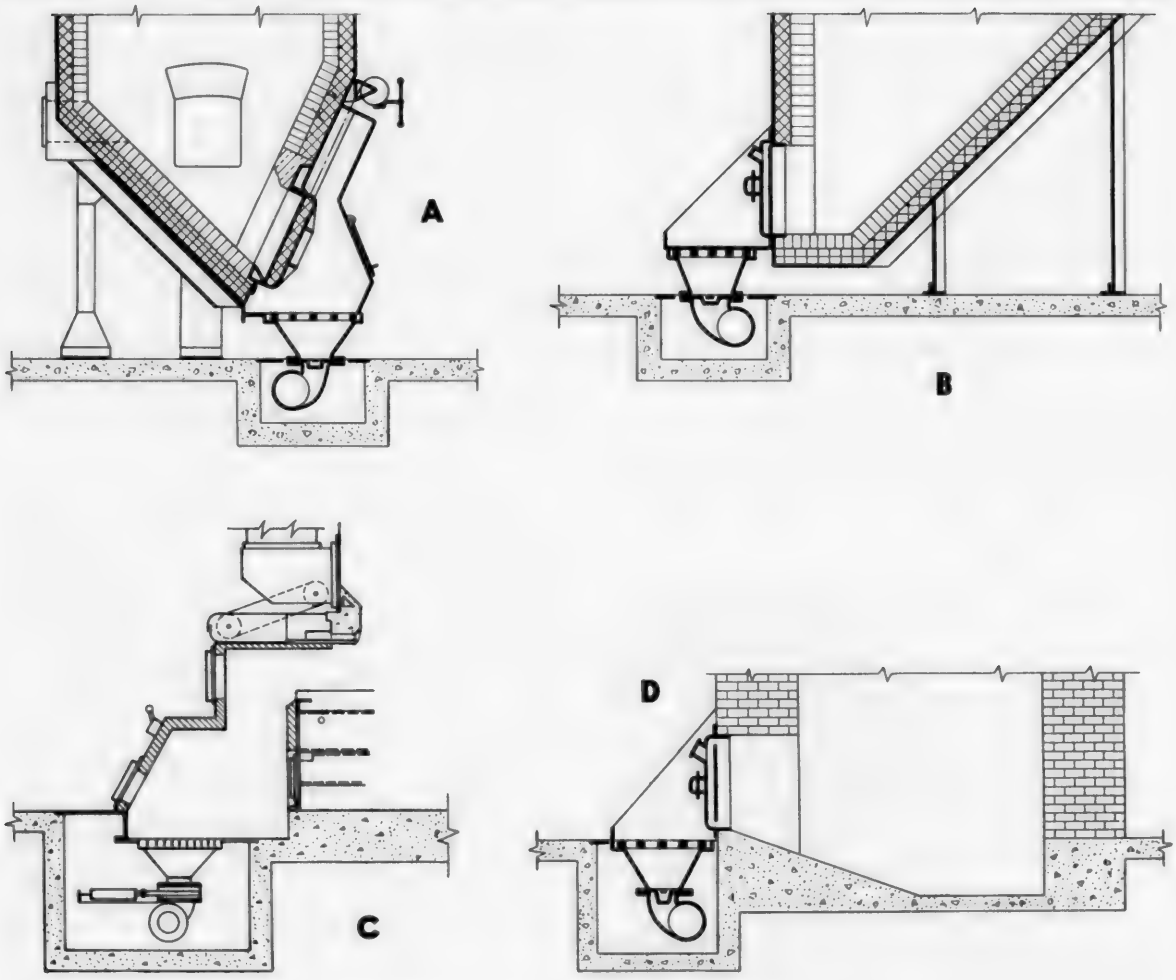


Fig. 7. Typical designs of bottom-ash intakes.

wheel connected to a rack and pinion, or pneumatically through an air cylinder controlled by an electric solenoid. Typical valves are shown in Fig. 8. A similar valve may be designed to remove fly ash collections at the base of the stack.

Conveyor Piping

Ash conveyor piping and fittings represent about 20% of total material costs. These components are subject to more wear than any of the other components; therefore, no compromise in quality is recommended. All elbows and laterals are usually provided with handholes and removable wear backs or impact plates not less than 1½ to 2 inches thick. Wear backs are normally cast of abrasive-resistant metal with a Brinell hardness not less than 350.

Three types of pipe are available for ash-handling systems: sand-cast abrasive-resistant pipe; centrifugally cast abrasive-resistant pipe; and extra-heavy black steel pipe. Type selection usually depends on the severity of service expected.

Sand-cast pipe comes in wall thicknesses of ¾ inch for 6-inch pipe and 15/16 inch for 8-inch pipe. Until recently this pipe was the most acceptable type for ash-handling systems but has been surpassed by centrifugally cast pipe.

Centrifugally cast pipe has generally superseded sand-cast pipe because of its lower cost, freedom from warpage and soft spots, uniform wall thickness and availability in a wide range of Brinell hardness from 250 to 550. Centrifugally cast pipe comes in plain ends and standard wall thickness of 0.50 inch for 4-inch dia pipe, 0.55-inch for 6-inch diameter pipe, and 0.65-inch for 8-inch dia pipe. It is priced in direct proportion to hardness. Pipe in the lower hardness range costs approximately half as much as sand-cast pipe.

Extra-heavy black steel pipe is not usually considered for use in sections of the system handling bottom ash where abrasive action is severe but is sometimes specified for fly ash handling branches with capacities not exceeding 2 or 3 tons per day.

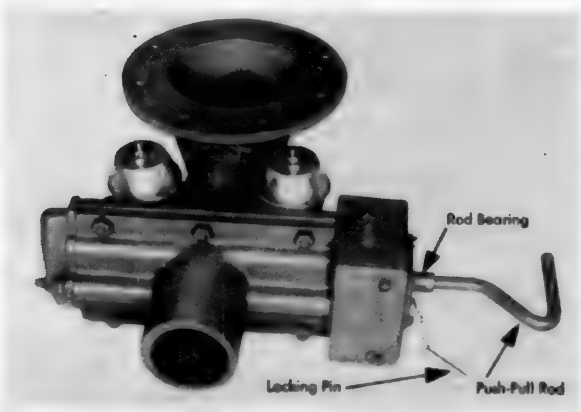
Generally, the price of extra-heavy black steel piping is about one-fourth that of sand-cast pipe and one-half that of centrifugally cast pipe. With each type, the price increases with the hardness of the pipe.

Pipe Selection

Selection of pipe for a specific system is governed by the capacity of the system and the abrasive characteristic of the ash to be handled. Normally, pipe is sized according to capacity requirements, but where severe abrasion can be expected, the abrasiveness of the ash takes precedence in size and quality determinations.

In an average system handling less than 8 tons of bottom ash and fly ash per 24 hr, centrifugally cast pipe with a Brinell hardness of 250 to 300 is usually specified for main lines and one-size smaller pipe of the same quality for the fly ash branches. Thus, if the main conveyor piping is 8-inch, a 6-inch size would be used for the fly ash branches. Where the fly ash loading is light, extra-heavy black steel pipe is often substituted for centrifugally cast pipe.

For systems handling more than 8 tons of bottom ash and fly ash per 24 hr, higher quality piping, usually with a Brinell hardness of not less than 420, is normally specified. The same type of pipe, sand or centrifugally cast, is used for main and branch lines. Again, even in low-capacity systems, if the ash is extremely abrasive, it is good practice to use quality piping with a Brinell hardness of about 420.



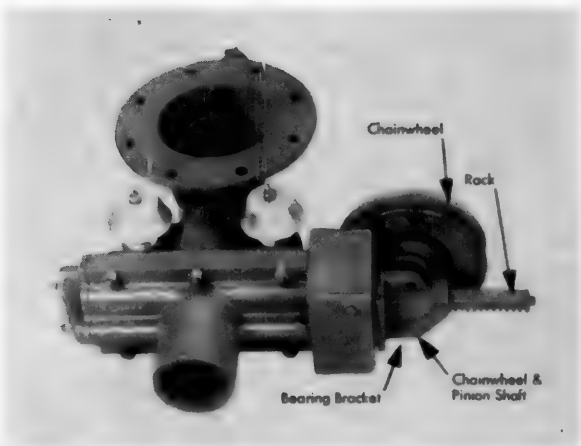


Fig 8. Push-pull rod (above) and chainwheel-operated (below) intake valves for cinder and fly ash hoppers.

Exhauster-Cyclone Separator

The exhauster-cyclone separator assembly of a pneumatic ash-handling system usually accounts for 20 to 40% of the cost of the standard system. Some manufacturers assemble these components at the plant and they are then installed as a unit on top of the ash storage silo. Other manufacturers prefer to assemble the unit in the field. The assembly includes primary and secondary cyclone separators, steam exhauster unit and air washer. A typical assembly is illustrated in Fig. 9.

The exhauster induces a vacuum of 5 to 12 inches of mercury in the conveyor lines. The induced flow of air carries ash dust from the hoppers to the primary and secondary separators, which are designed to separate out as much as 99% of the entrained ash and dust. When a steam exhauster is used, some of the remaining fly ash is caught by the condensed vapor and discharged into the stack. On a mechanical exhauster system on large installations, where residual dust from the separators may damage the exhauster, an air washer separates out the dust at a point before the exhauster inlet.

Steam Exhauster

Steam exhausters usually come in standard 6- and 8-inch sizes. Steam consumption of an exhauster depends on the design of the system it serves, the characteristic of the ash, the amount of ash to be handled and the temperature and pressure of the steam. A nozzle-tip orifice and throat diameter are installed in order to meet the conditions of a specific installation.

Normally, the 6-inch exhauster is used in systems

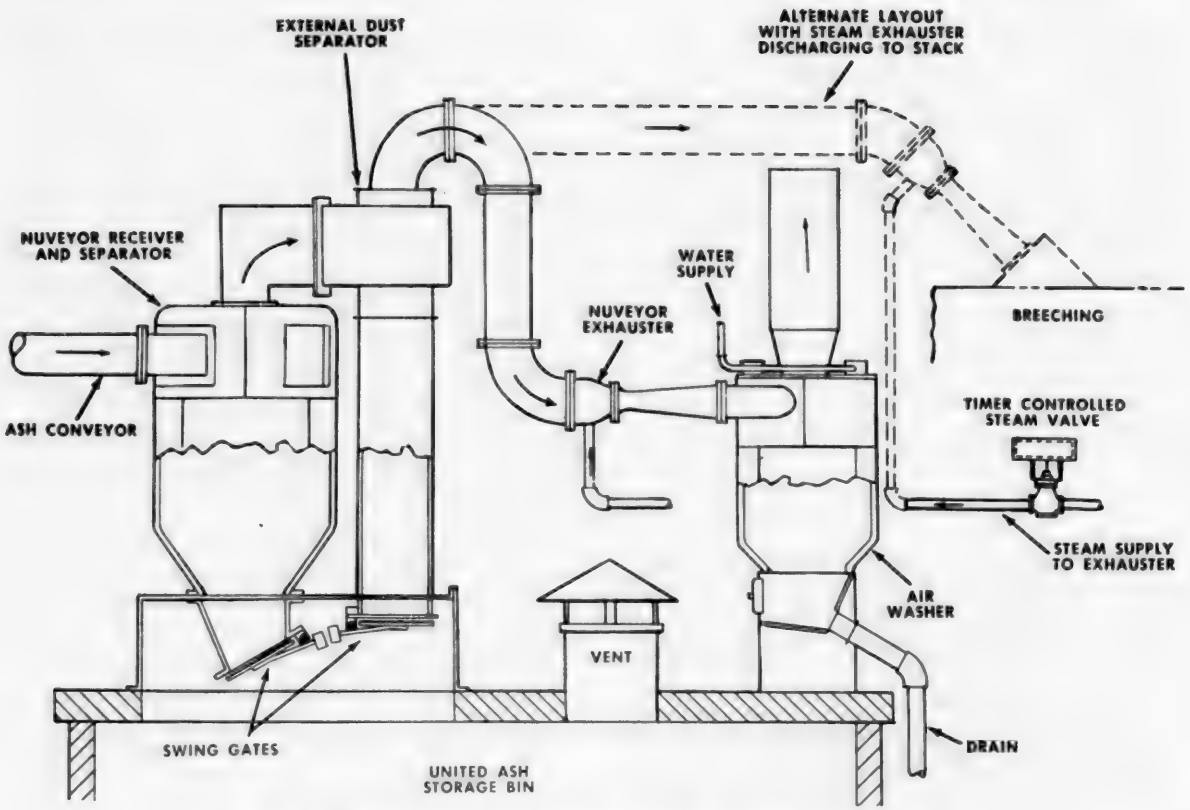


Fig. 9. Typical exhauster-separator assembly showing components.

where conveyor piping does not exceed 6-inch, and the 8-inch exhauster in systems fitted with 8-inch dia conveyor pipe. Steam consumption of 1,500 to 2,500 lb per hr for a 6-inch system and 2,500 to 3,500 lb per hr for an 8-inch system can be expected. The actual quantity of steam used varies at installations depending on size of nozzles, length of pipe, number of turns, and state of wear of the nozzles. The figures cited for steam consumption are useful only as a guide.

For efficient operation, steam supplied to the exhauster should not be less than 80 psig. A typical 6-inch pneumatic ash-handling system with a capacity of 6 to 14 tons per hr will require approximately 230 lb of steam per ton of ash conveyed.

Mechanical Exhauster

In coal-burning plants where high-pressure steam is not available to power a steam exhauster, the pneumatic ash-handling system can be activated by a mechanical exhauster. The system is essentially the same as when steam is used except that an air washer is usually recommended to protect the mechanical exhauster from excessive wear. The first cost of a mechanical blower is substantially higher than that of the steam exhauster.

Sizing a mechanical exhauster depends on ash characteristics and the capacity and design of the system. Exhausters are usually sized to induce velocities of 3,000 to 5,000 fpm in the conveying piping and to create negative pressures that seldom exceed 5 psi below atmospheric pressure.

Because of the many variables in an ash-handling system, little published data are available. Sizing and performance are difficult to predict except on the basis of experience. Reputable manufacturers have a sound groundwork for empirical formulas for air velocity, volume of air required per pound of ash conveyed and power requirements, and their designs are uniformly successful. The empirical nature of these data and the wide range of variables involved limit the usefulness of generalized formulas and consequently have discouraged their publication.

Target Box

Under certain conditions in small coal-burning plants, the cost of the ash-handling system can be substantially reduced by installing a target box

arrangement and discharging ashes directly into the ash storage silo or bunker. The conditions are that a pneumatic ash-handling system of less than 6 tons per hr capacity is feasible; that the plant is in a location where some dust can be tolerated; and that the ash handled is not fine but granular.

For example, the cyclone separator assembly for a pneumatic ash-handling system of 6 tons per hr capacity costs about $3,000. A target box for the same system costs about $600, or one-fifth the cost of a cyclone separator assembly.

Storage Silos and Bunkers

In the standard ash-handling system, ashes are normally stored in a cylindrical tile or steel elevated silo until final disposal. Ashes are also directly deposited in low fill land where available. Ashes can often be deposited in gondola cars when disposal areas are some distance from the plant. Elevated silos are used in most installations. In plants that are operated 7 days a week, 24 hours a day, silo capacities are large enough to hold 3 or 4 days' accumulation. It is good practice to unload silos frequently. The capacity of the silo should always be great enough to assure a full load for the truck or gondola car used to transport ash to the place of final disposal.

Cylindrical ash storage silos are generally favored because maximum utilization of structural material is attained, ash arching and dead storage space are kept to a minimum and a stronger structure can be built. Vitrified glazed tile and steel plate are the structural materials commonly used. There is little difference in cost between a tile and steel silo. Tile is generally favored because it resists corrosion and requires less external maintenance, and its smooth glazed interior surface promotes free flow of ash to the discharge gate.

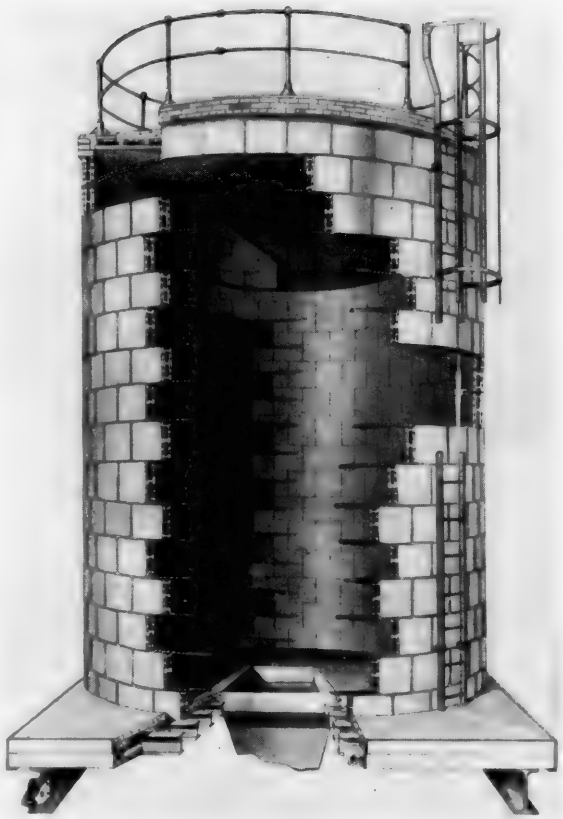


Fig. 10. Typical construction of tile ash silo.

Typical construction of a tile silo is shown in Fig. 10. Each manufacturer usually offers his own series of standard silos, the sizes and dimensions of which differ from those of other series. Standard silos offered by one manufacturer are listed in Table 3.

TABLE 3.—STANDARD SILO SIZES
(As offered by one manufacturer)

Inside Dia, Ft	Inside Height, Ft-In.	Gross Capacity*		Live Discharge Capacity	
		Cu Ft	Tons	Cu Ft	Tons
8	12- 6	630	14	460	10
9	14- 5	920	20	670	15
9	18- 9	1190	27	890	20
10	19- 9	1550	35	1130	25
12	18- 9	2120	48	1340	30
12	20-10	2360	53	1580	35
12	22-11	2600	59	1820	41
12	25- 0	2840	64	2060	46
14	22-11	3490	79	2230	50
14	27- 1	4150	94	2890	65
16	27- 1	5380	121	3560	80
16	31- 3	6270	141	4450	100
18	33- 7	8540	190	6700	150
20	36- 4	11500	260	8900	200
22	38- 5	14600	330	11100	250
22	43- 7	16500	370	13300	300

* Capacity in tons based on ash weighing 45 lb per cu ft.

The ash storage silo is usually the largest structural component of a pneumatic ash-handling system and accounts for 25 to 35% of the cost of the standard system.

In small coal-burning plants where a large investment in ash-handling equipment cannot be justified, a simplified system, using a ground-level cinder block bin instead of an elevated silo, can be installed. (See Fig. 2). A front-end loader is used

Fig. 11. Dustless unloading can be achieved with an ash conditioner such as this.

to empty the bin periodically. An alternate scheme is to use elevated bins of smaller storage capacity from which ashes can be emptied into a truck for final disposal.

Silo Unloading

Ash and fly ash storage silos are unloaded wet or dry depending on cleanliness requirements of the plant site and the commercial properties of the ash handled. Wet unloading is done by a batch-type mixer unloader or by a continuous ash conditioner.

In smaller installations and in industrial areas where some dust can be tolerated, ash from storage silos is unloaded dry through enclosed chutes and the ash wetted down during unloading or after it is in the truck or railroad car. At plants producing a commercial grade of fly ash, unloading is done dry into special fly ash trucks or cars. In other cases the fly ash is bagged directly from the storage silo.

At larger plants where some dust can be tolerated, silos are fitted with large segmental discharge gates with hinged chute and water sprays. Each batch of ash is wetted down before it is dropped into the truck for final disposal.

At plants where dust is a critical factor, such as in residential areas and at service institutions and hospitals, dustless unloading can be achieved by use of an ash conditioner (Fig. 11). This discharger consists of a motor-driven rotary drum that mixes ash with water in proper proportions to moisten all dust particles.

Unloading equipment costs range from a few hundred dollars for direct unloading chutes for dry removal to about $4,000 for ash conditioners. A large segmental or slide discharge gate with hinged chute and water spray costs about $700, including appurtenances.

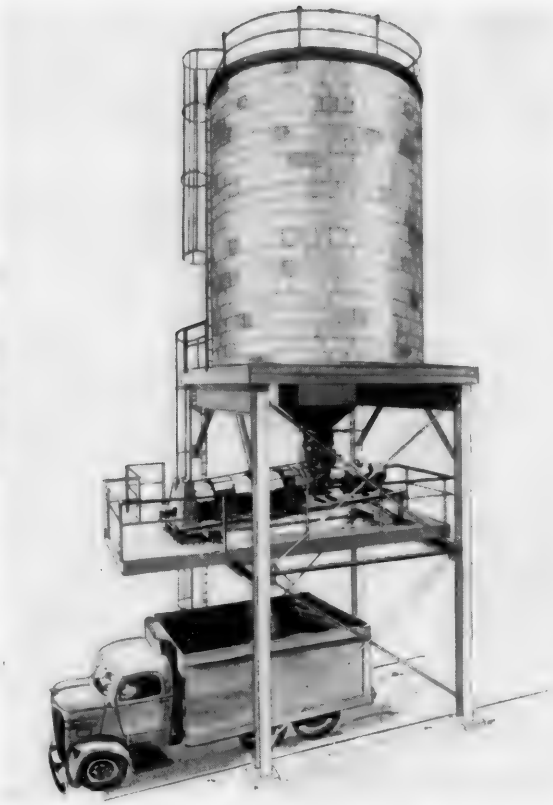


Fig. 12. Typical installation of an ash conditioner.

When there is some doubt about the need for the expensive ash conditioner, it is good practice to specify the segmental or slide gate with water spray and to provide structural supports for the ash conditioner in case future requirements call for the degree of cleanliness that can be achieved by its use. A typical ash conditioner installation is shown in Fig. 12.

Manufacturers

Manufacturers of pneumatic ash handling systems include: Allen-Sherman-Hoff Co., Wynnewood, Pa., Beaumont Birch Co., Philadelphia, Pa., Brady Conveyors Corp., Skokie, Ill., Dracco Div., Fuller Co., Cleveland, Ohio, Durabilt Conveying Systems, Division Chicago Fire Brick Co., Chicago, Ill., Hydro-Ash Corp., Chicago, Ill., National Conveyor Co., Inc., New York, N. Y., Pettibone Mulliken Corp., Chicago, Ill., United Conveyor Corp., Chicago, Ill., and Vacuum Ash and Soot Conveyor Co., Newark, N. J.

HYDRAULIC ASH-HANDLING SYSTEMS

Hydraulic ash-handling systems use water to transport ash to a suitable low-lying disposal area or to a dewatering or decantation bin that is periodically emptied. Hydraulic jets sluice ash from the boiler ash pit into an 8- or 10-inch pipe or trough and move it along by booster jets to the disposal area.

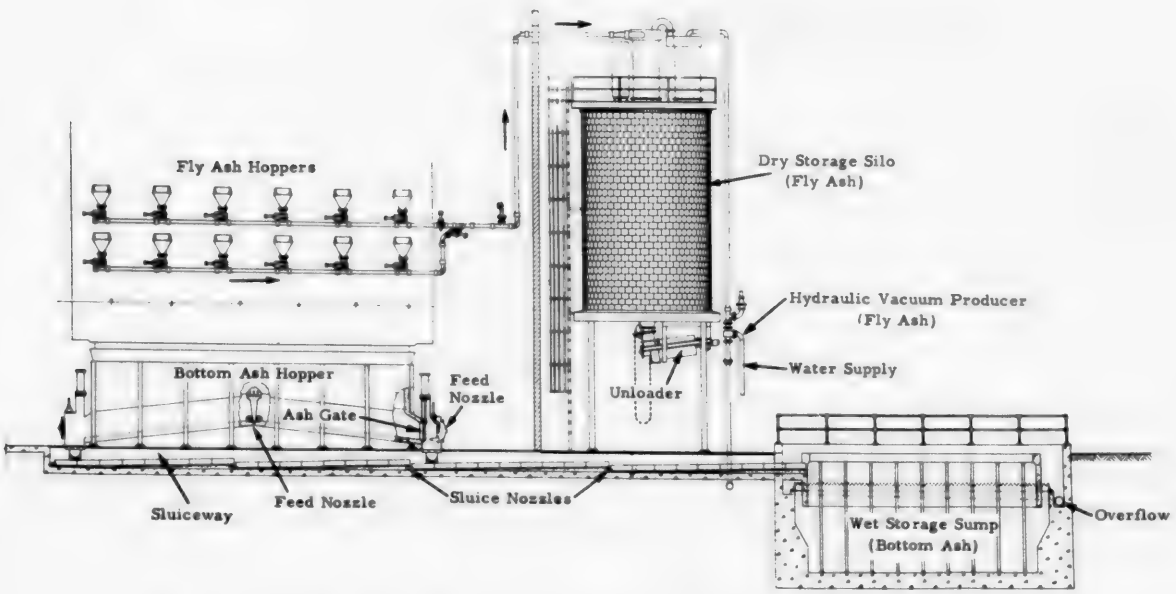


Fig. 13. Hydraulic ash-handling system suitable for larger installations. Bottom ash is handled hydraulically. Fly ash is handled pneumatically by hydraulic vacuum producer.

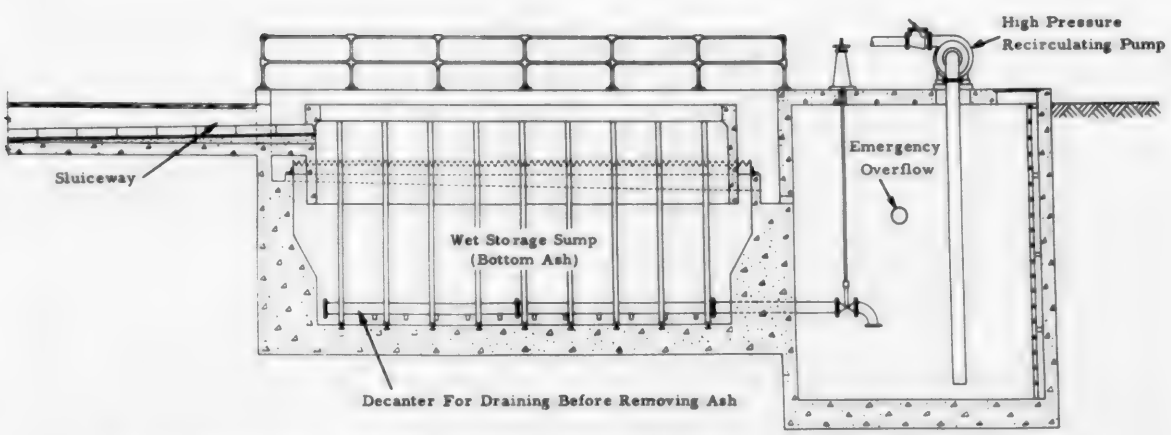


Fig. 14. Decantation sump for hydraulic ash-handling systems where water is recirculated.

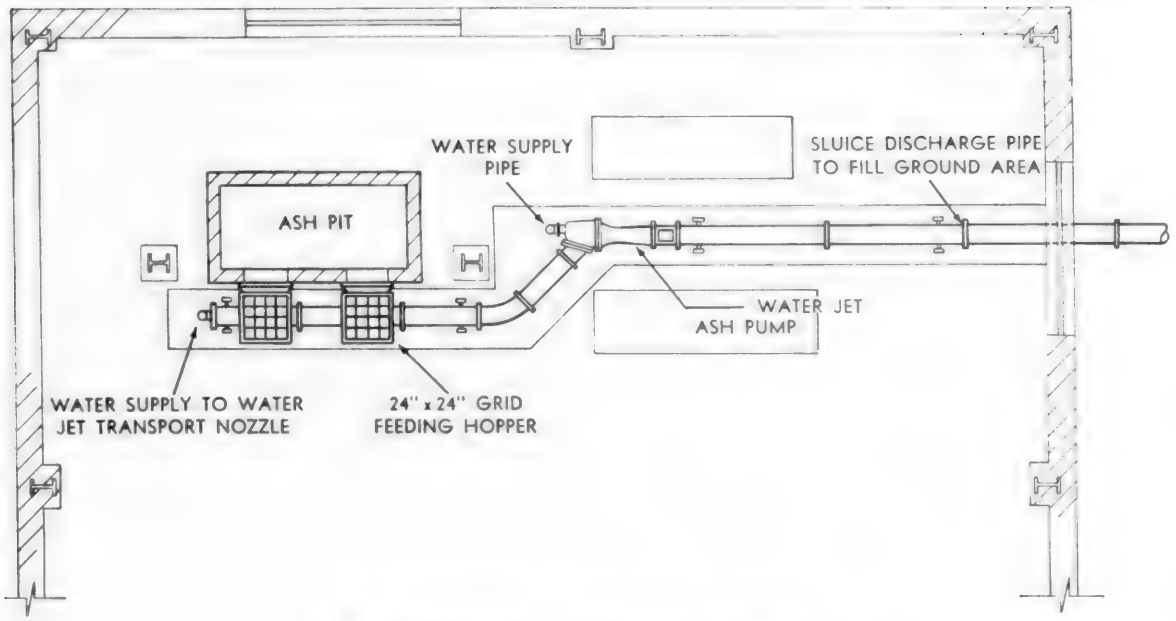

WATER SUPPLY PIPE
SLUICE DISCHARGE PIPE TO FILL GROUND AREA
ASH PIT
WATER JET ASH PUMP
WATER SUPPLY TO WATER JET TRANSPORT NOZZLE
24" x 24" GRID FEEDING HOPPER

Fig. 15. Simplified system discharging to fill area.

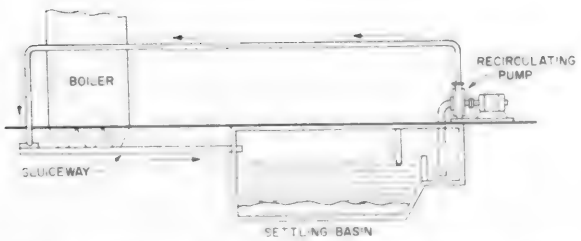


Fig. 16. Simplified system discharging to settling basin.

Conventional hydraulic ash-handling systems, which require moderate to high investment and large quantities of water, can usually be justified for medium to large industrial or public utility plants.

Hydraulic systems have enormous ash-handling capacities, ranging up to a ton a minute. Hydraulic ash conveyors are dustless and safe. They have no moving parts except pumps, and maintenance is low because ash is carried in suspension with little abrasive action.

Decanting basins or elevated bins are used at sites where no fill areas are available for ash disposal. Although basins and bins are expensive, they have the advantage of conserving water and eliminating stream pollution. When ash has settled in the receptacle, water is drawn off to be recirculated through the system. Ash is removed periodically.

Hydraulic systems are not generally recommended for handling fly ash because the fineness of fly ash makes dewatering difficult. In some installations, where the fly ash component is less than 20% of the total ash handled, decanting hydraulic ash-handling systems perform satisfactorily on both bottom ash and fly ash.

Details of a hydraulic ash-handling system for a large installation are shown in Fig. 13. Here bottom ash is sluiced to a settling basin or wet storage sump. A decantation sump can be added as shown in Fig. 14 to remove water from the wet storage sump. The decanted water drains into the separate sump where a high-pressure recirculating pump returns it to the sluicing nozzles. In this system the fly ash is handled pneumatically by use of a hydraulic vacuum producer.

Simplified systems as shown in Fig. 15 and 16 can be used for smaller installations. The extent of simplification is governed by plant conditions.

Manufacturers

Among the manufacturers of hydraulic ash handling systems are: Allen-Sherman-Hoff Co., Wynnewood, Pa., Durabilt Conveying Systems, Div. Chicago Fire Brick Co., Chicago, Ill., Hydro-Ash Corp., Chicago, Ill., National Conveyor Co., Inc., New York, N. Y., and United Conveyor Corp., Chicago, Ill.

MECHANICAL ASH-HANDLING SYSTEMS

Mechanical ash-handling systems use screw, drag, pan or bucket conveyors or skip hoists to move ash from the boiler ash pit to the storage silo or bin. Mechanical systems are used primarily with underfeed, spreader and chain or traveling grate stokers. The fine ash from pulverizers is handled more easily by other means. The boiler ash pit is usually designed to hold ash accumulated during an 8-hr shift. The system is designed to transfer accumulated ash to the storage silo or bin in one hour or less. Conveyors are enclosed in dusttight housings to eliminate the escape of dust during operation. Elevated silos, ground-level storage bins or portable containers are used for storage.

In smaller plants where ash is deposited automatically in ashcans, ash-handling systems include a monorail conveyor and electric hoist to transfer ash cans to the storage and pick up area.

Mechanical ash-handling systems using screw or bucket conveyors singly or in combination are suitable for smaller plants where the distance between the boiler ash removal doors and the outside ash storage facility is short, usually 50 ft or less. The layout of a particular system is determined by the type of boiler and stoker to be served, the architectural features of the building and the contours of the site. Typical arrangements are shown in Figs. 17, 18 and 19.

Unless the amount of ash to be handled is moderate and the distance to outside storage relatively short, the cost of screw or bucket conveyors will approach that of a comparable pneumatic ash-handling system. Under the right conditions, however, there is much in the mechanical conveyor ash-handling system to commend it to operators.

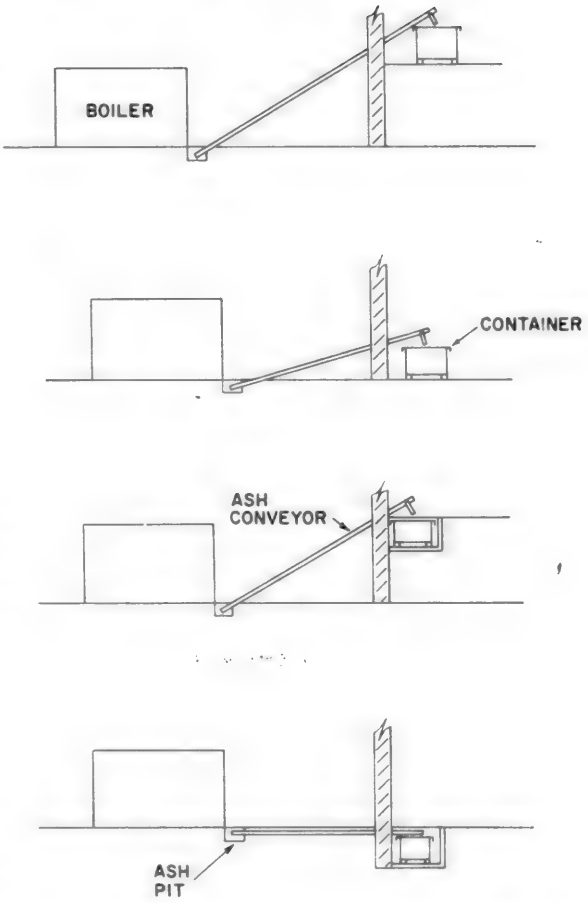


Fig. 17. Various arrangements of screw or flight conveyors emptying to portable container.

Screw Conveyors

Screw conveyors, used in small plants to transfer ashes horizontally or up inclines to about 30 degrees, are relatively simple in construction, are readily made dusttight and cost substantially less than any other type of mechanical conveyor. Screw conveyors are effective when the largest lumps of ash are proportionally smaller than the diameter of the helix of the screw. Conveyors with cast-iron screws, operating at low speeds in a trough-type housing and properly loaded, are not subject to excessive wear of mechanical parts even when handling abrasive ashes.

The capacity of screw conveyors used in an inclined position decreases as the angle of incline increases. The normal reduction in capacity to be expected when a standard-pitch helical-screw conveyor is used in an inclined position is as follows:*

Incline (degrees)	*Reduction in capacity (%)*
10	10
15	26
20	45
25	58
30	70

Handling capacities of standard-pitch screw conveyors when operated at manufacturer's recommended maximum speeds and at 15% trough loadings are listed in Table 4. Trough loadings much in excess of 15% are not recommended because increased wear will normally result. With some types of ash, loadings up to 25% can be tolerated but are usually not recommended.

* (Source: Marks' Mechanical Engineers' Handbook, 6th ed., 1958, pp. 10-49.)

TABLE 4.—CAPACITIES AND SPEEDS OF HORIZONTAL SCREW CONVEYORS

(When handling ashes with 15% trough loading. Source, Link Belt Company Catalog 1000)

Screw Dia, Inches	Max. Lump Size, Inches	Max. Recommended Speed*, rpm	Capacity Lb per Hr at 1 rpm**	Capacity at Recommended Speed, Lb per Hr
6	¾	60	34	2,025
9	1½	50	126	6,300
12	2	50	302	15,075
14	2½	45	473	21,150
16	3	45	707	31,725
18	3	40	1022	40,950
20	3½	40	1400	55,800

* Higher speeds will cause excess wear. When handling abrasive ash, use lower speeds.
** Ash at 45 lb per cu ft.

Flight Conveyors

A flight conveyor consists of one or two endless chains carrying properly spaced scrapers or flights for moving granular or lumpy material along a length of stationary trough.

Flight conveyors for ash handling should be the double-strand type rather than single strand so that clinkers can enter the trough without interference. The bottom of the trough should be a hard-faced concrete or removable cast-iron plate. Speeds should be kept well under 100 fpm to minimize wear.

Screw vs. Flight Conveyors

The choice between screw and flight conveyors is mainly an economic one. Screw conveyors are usually less expensive to install but are limited to handling small-diameter clinkers. Flight conveyors, however, are able to handle larger clinker sizes. Horizontal and vertical distances of transfer often dictate the choice between screw or flight conveyors in small installations. In large installations the choice is between flight conveyors and pneumatic or hydraulic systems. Thorough consideration should be given to installation cost, service expected, space occupied, maintenance costs and cost of operation before the system is selected. Pneumatic or hydraulic systems are likely to be most economical in larger plants.

V-Bucket Elevator Conveyors

V-bucket conveyors are structurally similar to flight conveyors except that flights are replaced by buckets. The V-buckets serve the double purpose of elevating and horizontal conveying. Because of high cost, the V-bucket conveyor-elevator is usually not considered for use solely for handling ashes. In larger plants, where integrated ash- and coal-handling systems are economically justifiable, the V-bucket conveyor is used primarily for coal handling and incidentally to remove ashes.

Continuous Bucket Conveyor

The continuous bucket or Peck carrier conveyor is also used to remove ashes in installations where this type of combination coal- and ash-handling installation is economical.

Electric Hoists and Monorails

In smaller heating plants where ash can be handled conveniently in covered, dustless ash containers

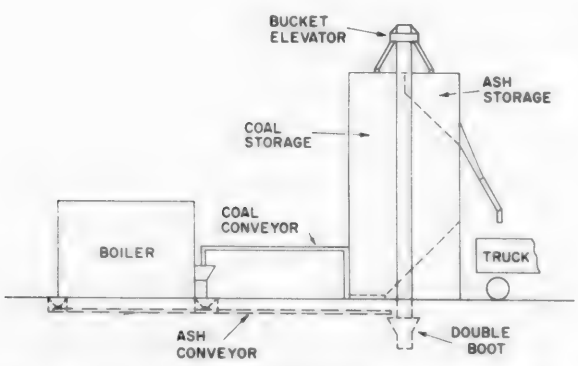


Fig. 18. Arrangement of mechanical conveyors handling coal and ash.

Fig. 19. Coal silo with ash storage space in lower part.

weighing up to 200 lb, and where the boiler room is below ground level, ash containers are transferred horizontally by handcar and vertically by an electric hoist to ground-level storage. Monorails fitted with an electric hoist are used to advantage for horizontal transfer in some installations. Modern coal-fired boiler units that automatically fill covered, dustless ash containers preserve the cleanliness and orderliness of the boiler room and make container transfer by electric hoists simple, clean and rapid.

Manufacturers

Mechanical ash handling system manufacturers include: Beaumont Birch Co., Philadelphia, Pa., Dayton Automatic Stoker Co., Dayton, Ohio, and The Godfrey Conveyor Co., Elkhart, Ind.

SPECIAL ASH-HANDLING SYSTEMS

Coal-Fired Package Boilers

The recent development of coal-fired package boiler units represents an important advance in handling ash for small and medium-size heating and process steam plants. Ash-handling equipment is an integral part of the boiler and is operated by the combustion control system; ash accumulated in the boiler ash pit is automatically removed according to control settings. The ash is moved to an outside storage bin or dusttight containers in the boiler room. Such units make available to the coal consumer the same degree of automation, cleanliness and convenience as competitive fuel burning equipment and generally surpass it in economy of operation and safety.

The Coal-Pak Automatic is the best known of these coal-fired package boiler units. Similar automatic features are being developed for the Fire-Jet stoker and the Gough stoker; early designs of the latter units are already giving satisfactory service in many installations.

The Coal-Pak Automatic was developed by Bituminous Coal Research, Inc., and is manufactured under license by The International Boiler Works Co., East Stroudsburg, Pa. The units are available in a capacity range of 2,470 to 10,350 lb of steam per hr (71.6 to 300 developed boiler horsepower) in both the low-pressure and high-pressure series.

As shown in Fig. 20, the Coal-Pak Automatic is a complete package unit. The induced and forced draft fans, coal feeder and burner, and ash removal conveyor are integral with the boiler and are under the control of the combustion control system, which is also an integral part of the unit.

Ash is discharged from the end of the coal burner in loose, nonclinkered form and removed from the ash hopper by a screw conveyor. The ash conveyor operates automatically in conjunction with the coal-feed mechanism and can be adjusted to suit the ash content of the coal. The screw can be installed horizontally or in any other position to meet plant requirements.

Gough Stoker

Another concept of automatic ash-handling is illustrated in the recently developed Gough stoker, in which a reciprocating grate moves burning coal from front to rear of the furnace. When coal is fully consumed, residual ash falls into the trough of a screw conveyor and is moved out of the furnace to an ash container or to an exterior disposal area. The action of the ash-handling screw is coordinated

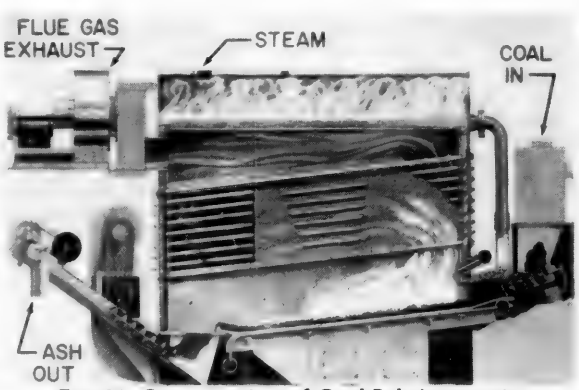


Fig. 20. Cutaway view of Coal-Pak Automatic.

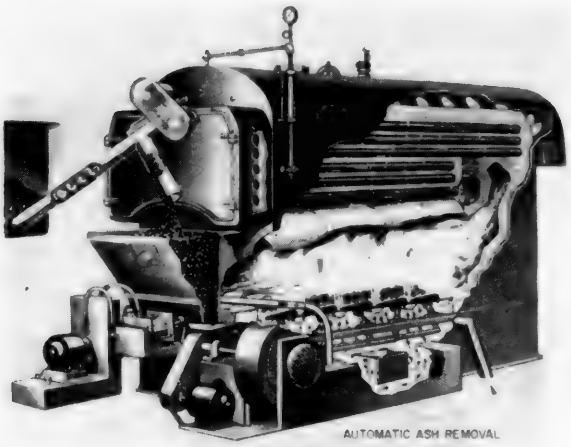


Fig. 21. Cutaway view of Gough stoker installed in a boiler.

Fig. 22. Fire-Jet mechanical ash-handling equipment, showing screw conveyor, bucket conveyor in housing, and dusttight ash containers.

with fuel feed, which is controlled by the combustion control system. Fig. 21 shows a cutaway view of the stoker in action and identifies the ash-handling system as the inconspicuous tube in the lower right of the drawing.

The Gough Stoker is manufactured by Salem Foundry and Machine Works, Inc., Salem, Virginia. It has been installed in schools and is providing excellent service as an automatic coal burner with automatic ash-handling features. The stoker is manufactured in capacities of 420 to 1,700 lb of coal per hr, and in grate areas of 16.67 to 55.8 sq ft.

Fire-Jet Equipment

Fire-Jet mechanical ash removal equipment (Fig. 22) like the ash removal system of the Gough stoker, consists of an ash-receiving trough and a screw conveyor that moves ash out of the furnace. Here it is picked up by a bucket conveyor and deposited in dusttight ash containers. Whereas the ash-conveying equipment is integral with the Gough stoker, the Fire-Jet equipment can be adapted for use with any boiler or stoker. The equipment was originally designed for use with the Fire-Jet anthracite stoker, but has been adapted for boilers using free-burning bituminous coal. The equipment can also be converted to pneumatic ash-handling by use of an exhauster instead of the bucket conveyor.

The Fire-Jet ash-handling equipment can be energized by the combustion control system and its operation correlated with the coal feed. This equipment is manufactured by Electric Furnace-Man, Inc., Emmaus, Pa.

SPECIFICATION FOR ASH REMOVAL SYSTEM

Following are standard specifications for pneumatic ash removal systems for smaller industrial and commercial installations, as proposed by National Coal Association, Washington, D. C.:

1. General Description of Equipment—The contractor shall furnish a complete pneumatic bottom ash and/or fly ash handling system for removal of ashes from ——— boilers.

The system shall be complete from the outlet of the ash pit doors and/or fly ash hoppers to the collecting equipment and the storage bin equipment which shall be arranged for easy disposal of ash.

All equipment and materials furnished shall be delivered with freight allowed to job site. This ash handling system shall be of the pneumatic, suction type.

The contractor shall furnish the ash systems, including the following items:

Ash intake fittings and hopper adaptors with sizing grids.

Ash conveyor pipe, fittings, joints, etc., to connect all equipment.

Fly ash valves.

Fly ash conveyor pipe, fittings, joints, etc., to connect all equipment.

Multi-jet steam exhauster or mechanical vacuum producer.

Steam valve and required control equipment or, with the mechanical vacuum producer, a vacuum breaker and required control equipment.

Primary and secondary collectors each with counterweighted dump gate.

Storage bin with capacity of ——— tons.

Vent for storage bin.

Equipment for conditioning ash and fly ash.

All nuts, bolts, gaskets and sealing materials required to completely assemble system.

The following items will be supplied by others:

Complete erection of all equipment and material specified herein.

All concrete work including foundations, trenches, etc.

Ash pit hoppers.

Doors and door enclosures.

All pipe supports for ash and dust conveyor lines outside of building trenches.

All air, water and steam supply piping.

All electrical wiring.

All mortar and concrete required for construction of storage silo.

2. Capacity—The system shall handle ashes and dust at the rate of not less than ——— tons of dry ash per hour. The ash to be handled will be dry ash.

3. Steam and Electrical Conditions—Steam for operation of the system will be available at ——— psig. Electrical service for motors of ½ hp and larger will be 220/440 volt, 3 phase. Electrical service for controls, lights and small motors will be 110 volt, single phase, a-c.

4. Quality of Materials—Materials used in construction of the apparatus shall be of first quality, free from all defects which would cause any unsightly or unworkmanlike appearance. All materials shall be suitable for the services which they are to perform, and the conditions and stresses to which they are normally subjected.

5. Castings—All castings shall be free from injurious blow holes, shrinkage cracks, flaws, scabs or other defects, and shall be smooth, close grained, homogeneous, tough, true to form and dimensions.

All castings shall be made in accordance with the best modern foundry practice.

6. Painting—All metal work furnished shall be given a shop exterior coat of basic lead chromate primer prior to shipment.

7. Guarantee—The contractor guarantees that apparatus furnished will be free from all defects in design, materials and workmanship, and will give successful service under the conditions specified. The contractor agrees to replace without expense to the Purchaser, any part of the apparatus which may prove to be defective within one year after apparatus is placed in operation.

8. Bidder's Exceptions to Specifications—This specification is intended for the guidance of the contractor, but vendors shall list separately every exception to the specifications. In case no exceptions are submitted with the proposal, it will be understood that the proposal conforms in all respects with this specification.

EQUIPMENT AND MATERIALS

Ash Hopper Inlet Fittings—Ash intake fittings shall be of hard iron casting specifically designed to permit feeding of ashes to a ——— (inch) conveyor pipe without danger of flooding or plugging the system. Each ash inlet fitting shall be furnished with a removable plug.

Ash Conveyor Pipe and Fittings—All bottom ash conveyor pipe and fittings shall be made of hard iron alloy suitable for abrasive service. The ash conveyor pipe shall have a minimum inside diameter of ——— (inches) and all fittings shall be provided with removable wearbacks having a minimum thickness at the wearing section of one inch.

Ash conveyor pipe shall be spun cast and shall have a uniform wall thickness of not less than ——— (inch). All straight pipe shall be furnished in the greatest lengths possible up to a maximum length of 16 ft. Pipe joints shall be kept to a minimum.

All ash conveyor pipe and fittings shall be provided with smooth ends for the use of sleeve type couplings. All sleeves, gaskets, nuts and bolts required for these pipe joints shall be furnished as part of this contract. Roller supports shall be furnished by the contractor for all ash conveyor pipe located in building trenches. Pipe supports or hangers for that part of the ash conveyor line outside the building trenches shall be provided by others.

Fly Ash Valves—Fly ash valves shall combine in one unit air inlet and segregating valve features to provide an air-tight arrangement which will feed fly ash to the conveyor pipe without flooding or clogging. The segregating portion of each valve shall consist of a sliding closing plate operated manually. Valves shall be arranged to connect with 8-inch standard ASME flanged fly ash hopper outlets and ——— (inch) fly ash conveyor pipe.

Fly Ash Conveyor Pipe and Fittings—All fly ash conveyor pipe and fittings shall be made of welded carbon steel and shall have maximum inside diameter of ——— (inches) and uniform wall thickness not less than ——— (inch).

Steam Jet Exhauster—On installations where steam is available, a steam jet exhauster of the multi-jet, high efficiency type shall be provided for producing the vacuum necessary for handling ashes through the system. The ejector body shall be made of abrasion resistant materials and the venturi throat made of removable ceramic lining.

The steam jet exhauster unit shall require not more than ——— pounds of steam per hour at ——— psig. The unit shall be capable of producing a vacuum of at least ——— inches of mercury at shut off. Note: Normally 1400 lb steam per hr at 60 psig and 15 inches of mercury at shut off.

Target Box—For use with a steam jet exhauster, a cast iron target box, with hard iron wear plates against which the conveyed ash will impinge and drop into the storage bin, shall be provided.

Primary Receiver—On installations where steam is not available, ashes shall be collected in a cyclone collector mounted on the roof of a storage bin. The cyclone collector shall be made of ¼-inch welded carbon steel plate of 21 inches minimum diameter, and shall be provided with necessary internal baffles to assure dropping of maximum quantity of solids from transporting air. The ash conveyor line shall enter the cyclone collector tangentially. Heavy hard iron wear plates shall be provided opposite point of entry of the ash pipeline into the cyclone.

Cyclone collector tank shall be equipped with an 18-inch dia counter-weighted dump gate. Dump gate must be hinged; no sliding or rubbing parts will be permitted. Dump gate shall be of all-steel construction and suitable gaskets shall be provided between the gate and frame to assure absolute tightness when closed. The gate shall be fully enclosed in a steel plate housing to provide absolute dust tightness between the bottom of the collector tank and the opening in the top of the storage bin.

Secondary Separator—The secondary separator shall be designed to remove a majority of the fly ash remaining in the air flow stream at the outlet of the primary receiver. The separator shall be constructed of not less than ¼-inch steel plate, of 10 inch dia, and shall be suitably reinforced or fitted with wear plates at anticipated points of wear.

Bag Vent—A bag vent for protection of the air exhauster against fine material carryover shall be provided. Suitable heat resistant bags enclosed in a No. 12 gage housing with hopper bottom shall be provided, arranged for periodic emptying of collected material into the storage bin.

Mechanical Vacuum Producer—The vacuum producer shall have sufficient capacity to convey 4 tons of ash per hour and shall be a motor driven mechanical vacuum producer of the centrifugal type. Motor shall be suitable for the service and shall operate on 3 phase, 60 cycle, 220 volts. Vacuum producer shall be mounted on a concrete base. The air line from the receiver to the vacuum producer and from the vacuum producer to atmosphere shall be not less than 6 inch dia constructed of No. 12 gage black steel. The discharge from the vacuum producer shall be equipped with a silencer of ample capacity.

Storage Bin—Ashes shall be stored in a cinder block enclosure or steel tank storage bin having a capacity of not less than 6 tons of ash and fly ash. Ash shall be considered to weigh 45 lb per cu ft as stored. Note: Size bin for 2-day (weekend) storage. Mortar and cement for construction of the silo will be supplied by others.

Roof of the cinder block storage bin will be of reinforced concrete construction.

Controls—Contractor shall furnish required push-button stations with indicator lights for starting and stopping the system.

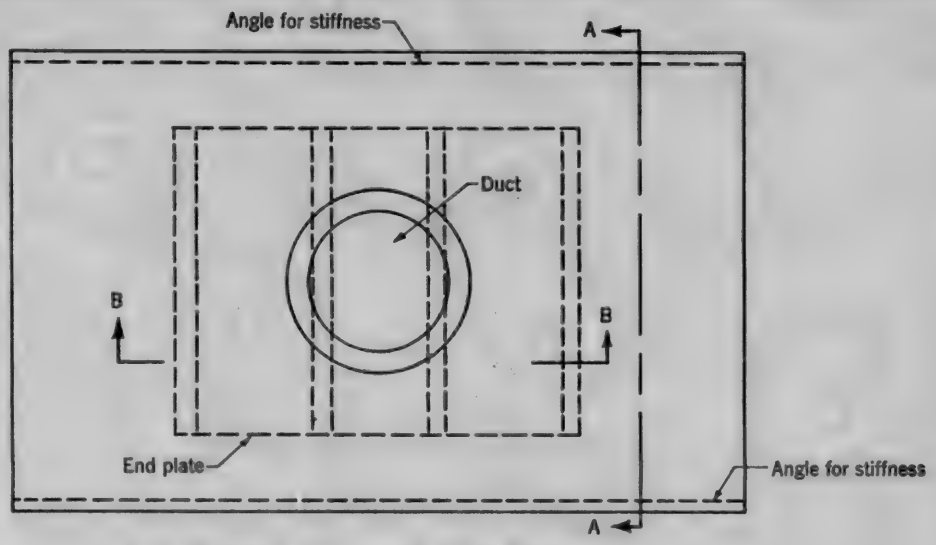
On a steam operated system, a manually operated shut-off valve shall be supplied to admit steam to the exhauster.

On a system using a mechanical vacuum producer, the contractor shall furnish a ⅜-inch solenoid operated valve for controlling the admission of air to the vacuum breaker. Air for the operation of this valve shall be supplied at 25 psig minimum.

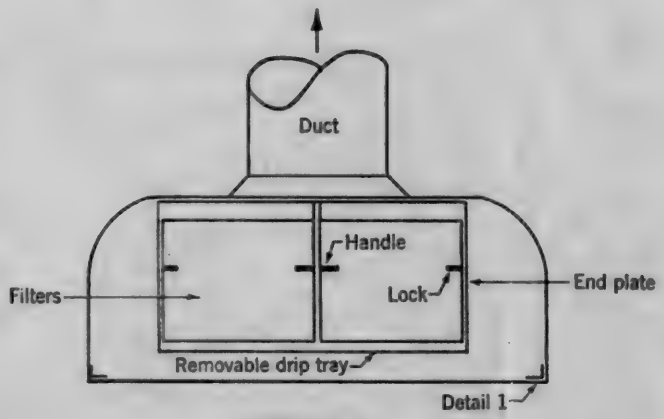
On installations that do not have air available, an air compressor shall be furnished complete with motor, motor starter and pressure regulator. Conveyor system shall be provided with an adjustable timer to automatically control the collection and dumping cycle by means of actuating the vacuum breaker, automatically opening and closing it as required. The contractor shall furnish all valves, switches, timers, etc., for this automatic feature of this system together with a wiring diagram. Equipment will be mounted and installed by others.

EXHAUST HOODS FOR COMMERCIAL KITCHENS

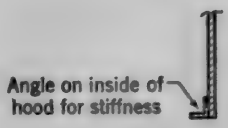
Island Type Hood with Grease Filters



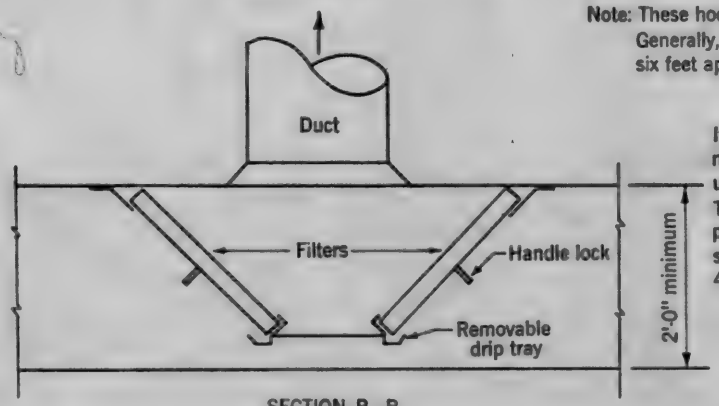
PLAN OF TYPICAL FULL CANOPY HOOD (ISLAND TYPE)



SECTION A - A



DETAIL 1



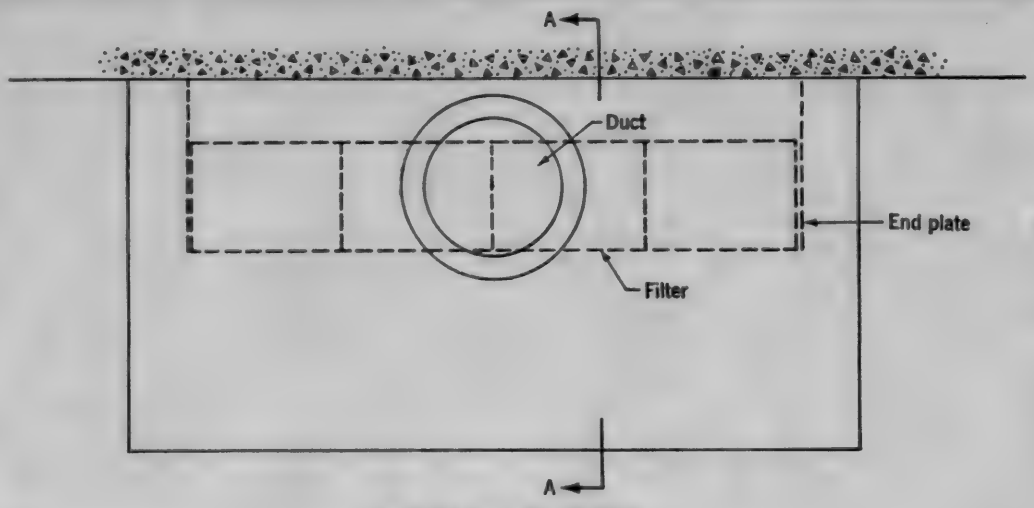
SECTION B - B

Note: These hoods are short and one outlet is sufficient. Generally, outlet ducts are spaced approximately six feet apart.

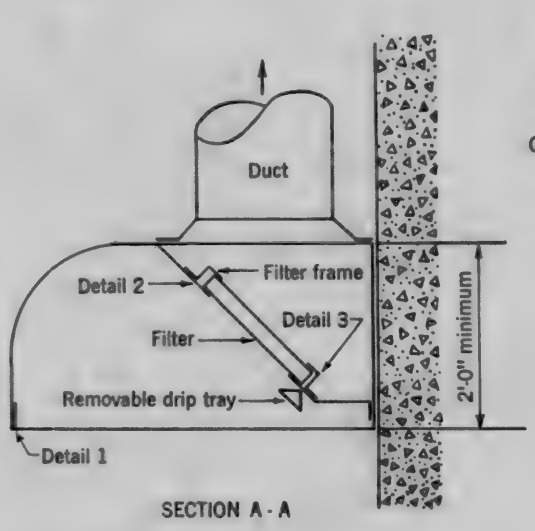
It will be noted that grease gutters are not used at edges of hoods because of unsanitary conditions created by them. The placing of filters in a horizontal plane is not recommended. All filters should be inclined at an angle of from 45 to 60 degrees with the horizontal.

EXHAUST HOODS FOR COMMERCIAL KITCHENS

Shed Type Hood with Grease Filters

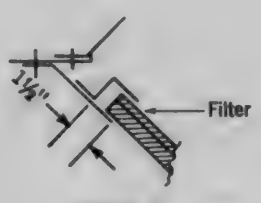


PLAN OF HOOD (SHED TYPE)



SECTION A - A

DETAIL 1
Grease gutters should not be used



DETAIL 2

Note: Locking devices may be used instead of holding channels at top and bottom of filters.

DETAIL 3

Drawings prepared by Harry E. Seifert, P.E., New York, N.Y.

Louis Blendermann on

PLUMBING and PIPING

Waste Systems for Laundry Machines

IN addition to the vast number of laundry machines installed in private residences, many commercial laundry establishments, commonly called laundrettes, have been erected. It is common for new apartment houses to include a laundry machine layout in the basement for the convenience of the tenants. A typical application may have from 6 to 40 units.

The laundry machines may be arranged in many ways to best satisfy space conditions. It is however, important, that the laundry machines be installed in a manner that conforms with the local health and plumbing departments' regulation. This article illustrates and describes the types of drainage systems normally used for the laundrette or commercial type laundry establishment.

A laundrette showing a typical arrangement of fixtures is illustrated in Fig. 1. It shows 20 washing machines at the center of the area. A typical arrangement of waste piping is shown, including a lint interceptor and a running trap in a concrete pit. Dryers are indicated at one side of the room. The remainder of the space is devoted to office, storage and equipment space. Not shown, are the various dispensing equipment, chairs, tables for folding laundry, and other miscellaneous items.

Although the layout shows a ground floor installation, the laundry machines may be installed at lower or upper floor levels in the building. The specific arrangement of roughing employed depends upon the layout of equipment and local code requirements.

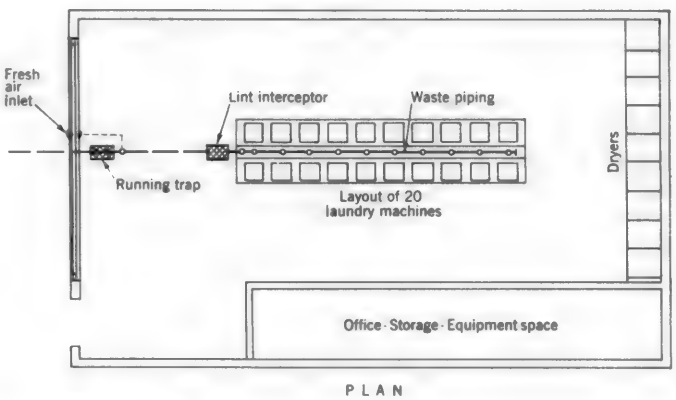


Fig. 1. Typical arrangement of fixtures, including twenty laundry machines, dryers, and basic waste piping, for a laundrette.

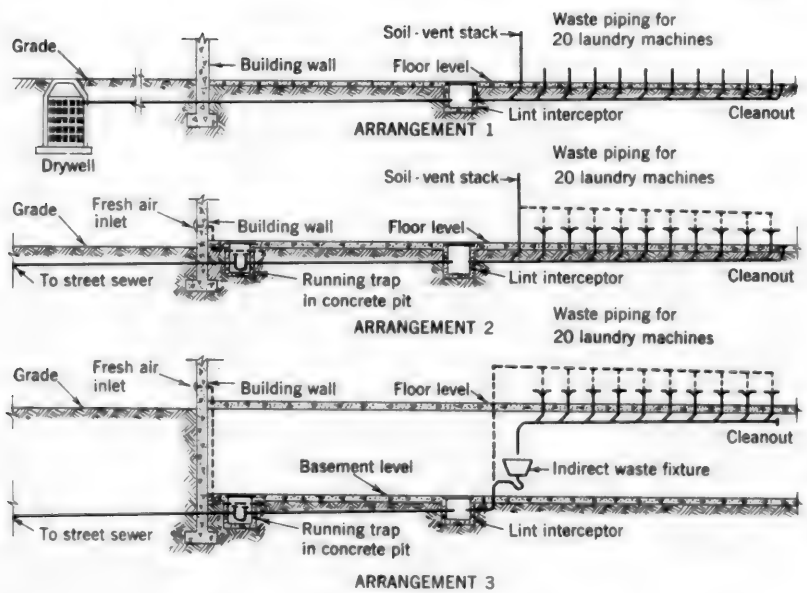


Fig. 2. Three arrangements of waste piping for the laundry machines shown in Fig. 1: discharge into a dry well, to exterior street facilities, and to basement drainage system.

Drainage Piping Requirements

Three roughing methods, Fig. 2, can be followed for the installation of the drainage lines from the laundry machines. There are other methods.

Arrangement 1, of Fig. 2 indicates how the drainage line can be installed when the waste is discharged into a dry well. Note that the waste first passes through a lint interceptor before it passes on to the dry well. Connections for the laundry machines indicate a standpipe type of waste connection, but it can be any type favored by the engineer. Furthermore, the arrangement used for an example shows a ground floor installation, it is also typical for upper or lower floor installations. The dry well or dry wells should be of a size and capacity that can handle the flow with regard to the specific percolation rate of the soil in which the wells are constructed. When properly designed and installed, this arrangement will function with the most satisfactory results.

In arrangement 2 the waste is conducted directly to the exterior street facilities. In this instance, indirect waste connections must be employed at the sanitary TY connections shown. The TY's have been individually vented. The waste then passes through the lint interceptor, the running trap and then on to the exterior street sewer facilities. This system, too, when properly designed and installed can be depended upon for very satisfactory performance.

Arrangement 3 shows how the drainage piping can be handled when the laundry machines are installed at ground floor level where a basement exists below this level. Here you will note that sanitary TY's are again used and are individually vented. The rubber discharge hose from the laundry machines may be connected directly to the TY's, and the waste piping is indirectly run to the fixture or receptacle located in the basement, as shown. This fixture must be properly vented. The waste water then passes through the lint interceptor and through the running trap on its way to the outside street sewer facilities.

In addition to the arrangements shown in Fig. 2, modified layouts with other methods of roughing may be used with equal success and must conform to local code requirements.

Laundry Machine Connections

Waste from laundry machines should not be directly connected to a sanitary system. This precaution must be taken to prevent contamination of the clothes in the laundry machine by a backflow in the sanitary system. Some of the methods which may be employed to accomplish a safe sanitary connection are shown in Fig. 3.

Detail *A* of Fig. 3 illustrates a direct connection to the waste piping. The rubber hose is connected directly to the Y fitting and this fitting is vented. When this type connection is used, the waste piping must discharge into a fixture that is properly vented and trapped. The waste piping in this instance may be regarded as an indirect waste system.

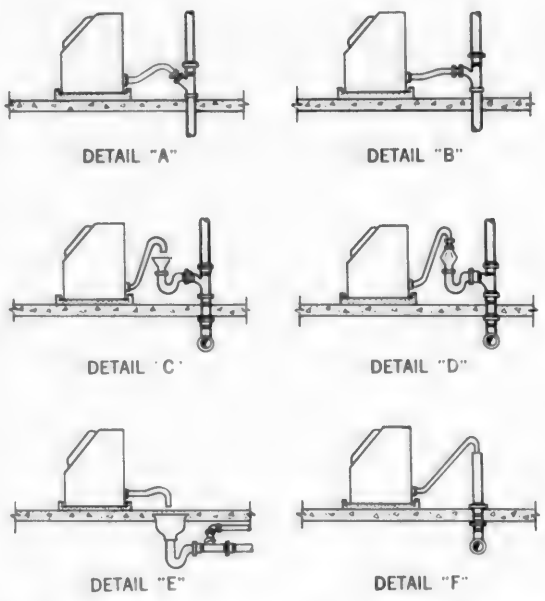


Fig. 3. Six ways to connect a washing machine to the waste system.

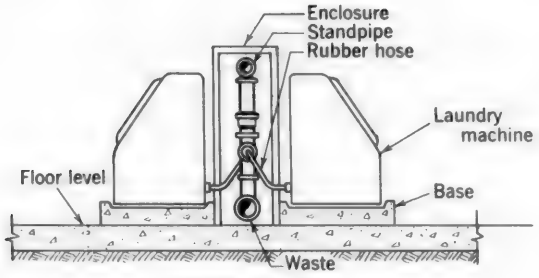
Detail *B* shows a direct connection to the waste line; here a sanitary TY is used. The waste piping must discharge into a fixture that is properly vented and trapped. The waste piping in this instance may also be regarded as an indirect waste system.

Detail *C* shows an indirect waste connection to the waste line. Here, the rubber waste hose discharges into a funnel which is properly vented and trapped. A sufficient air gap should exist between the hose termination and the funnel to safeguard against back siphonage. There are many ways of supporting the rubber hose above the funnel.

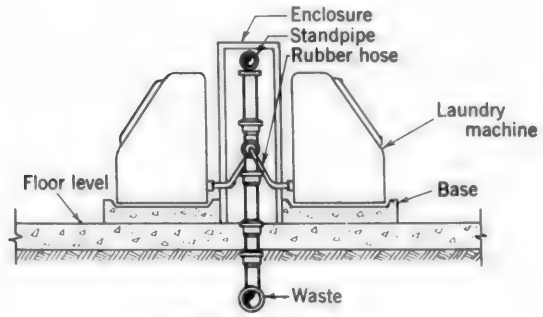
Detail *D* also shows an indirect waste connection. Here, the rubber hose is connected to a manufactured indirect waste fitting, which is properly vented and trapped. Open slots in the upper portion of the fitting provide the air gap needed to safeguard against back siphonage. The system in this case is the sanitary system of waste piping while the waste connection is indirect.

Detail *E* shows an indirect waste connection. The rubber waste hose discharges into an open drain which is properly vented and trapped. Several different types of drains are available for this purpose. In details *A* through *E* the drain is part of the sanitary system.

Detail *F* shows a connection to a standpipe waste system. The rubber waste hose in this instance is inserted into the standpipe and must be regarded as a direct waste connection. The drainage thereby must serve as an indirect waste system in that, it shall discharge into a fixture that is properly vented and



ARRANGEMENT 1



ARRANGEMENT 2

Fig. 4. Waste connections for back-to-back units.

trapped. If the waste piping is intended to serve as the sanitary system, then the rubber waste hose must terminate above the standpipe. Funnels are often employed in this case to avoid splashing when the waste is discharged from the laundry machine. Therefore, this method may serve two purposes, depending upon the manner in which the connections are made.

Methods, other than those illustrated in Fig. 3 can be used It is most important, however, that the requirements of the local plumbing code be consulted.

Back to Back Installation

Figure 4 illustrates a typical roughing which may be utilized for two laundry machines that are installed back-to-back.

Arrangement 1 features the roughing as installed above the floor slab. A double sanitary TY is used and the rubber waste hoses are shown as being directly connected. This means that the waste line must discharge into a fixture that is properly vented and trapped. If the hoses are to be indirectly connected, one of the indirect means of connection as shown in Fig. 3 must be used. The roughing is concealed in an enclosure as illustrated.

Arrangement 2 is the same as Arrangement 1 except that the horizontal waste line is installed below the floor. The hook-up regarding indirect waste connections is the same as that described in Arrangement. 1.

In both cases, ground floor installations have been shown. However, the arrangements can be applied to upper or lower floor slabs, as well. When the waste piping for the ground floor slab application is to be an indirect system of piping, the waste must be discharged into a drain or pit that is properly vented or trapped. A sump pump installation can also be used.

Figure 4 represents a section through the battery of laundry machines shown in Fig. 1.

Installation of Roughing

Figure 5 shows the elevation of roughing illustrated in Fig. 4.

Included in Installation 1 are the horizontal waste line, the sanitary TY's, the vent piping and the soil vent stack. If the rubber waste hoses from the laundry machines were directly connected to the TY's, then the horizontal waste piping must be discharged into a fixture, pit or sump pump that is properly trapped and vented. If the roughing is to be a direct part of the sanitary system, then the rubber hoses must be connected to the TY's by one of the indirect means illustrated in Fig. 3.

Installation 2 is the same arrangement as the previous one with the exception that the horizontal waste piping is installed below the floor slab. It, too, must be discharged into a fixture, pit or sump pump arrangement that is properly trapped and vented, if the rubber hoses are directly connected to the drainage fittings. Both installations can be applied to laundry machines installed at upper or lower floor levels.

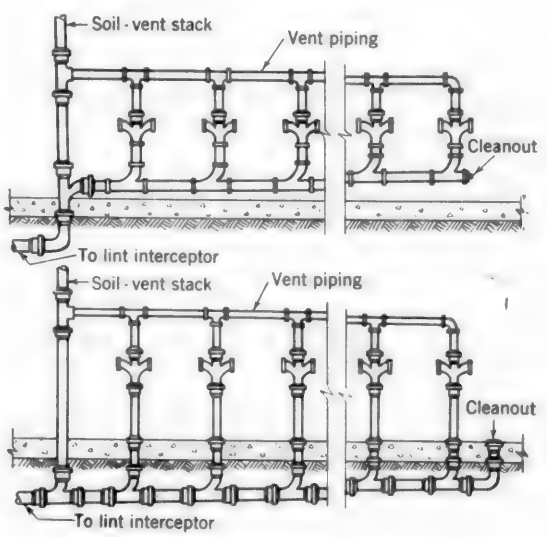


Fig. 5. Elevation of roughings for installation of back-to-back laundry machines shown in Fig. 4.

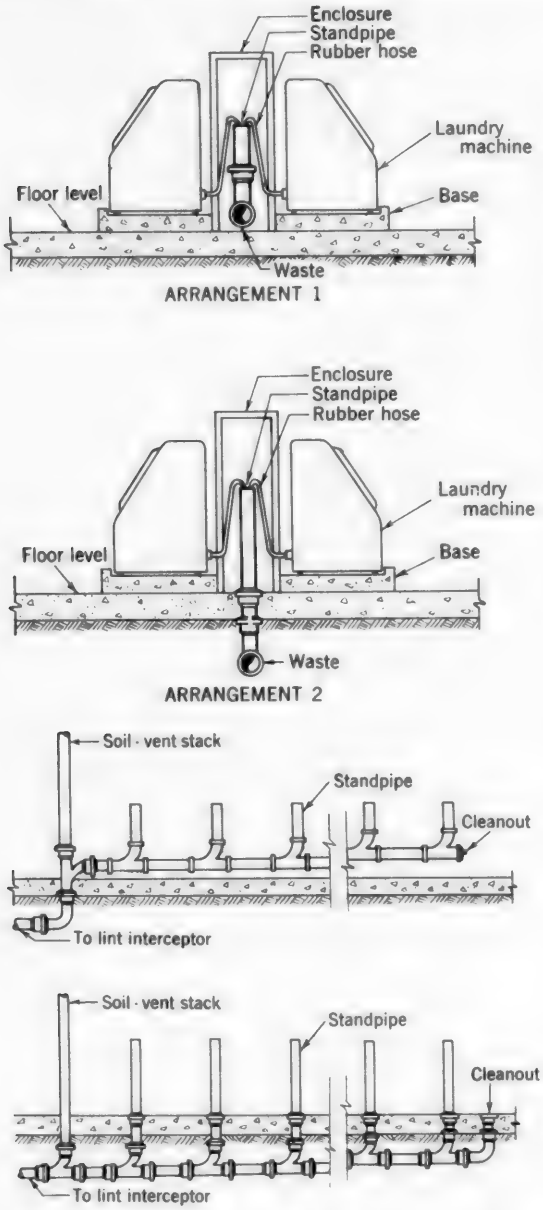


Fig. 6. (top). Roughing and (Fig. 7) elevation of standpipe systems.

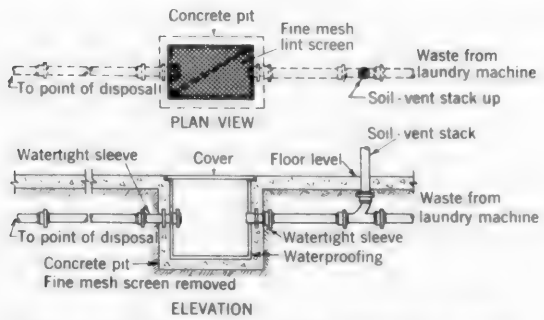


Fig. 8. Lint interceptor with removable screen.

Figure 6 shows the standpipe method of roughing that has been used in laundry roughing installations. In this figure, Arrangement 1, illustrates the standpipe waste connection and the manner in which the rubber hoses discharge into it. The horizontal waste is installed above the floor slab. If the system is used as shown, then the horizontal waste piping must be discharged into a drain, pit or sump pump arrangement that is properly trapped and vented. Otherwise, the rubber hose must terminate above the standpipe and serves as an indirect waste connection. A funnel or enlarged opening at the top of the standpipe will serve to avoid splashing when the waste is discharged from the laundry machines.

Arrangement 2, is exactly the same as Arrangement 1, with the exception that the horizontal waste piping is installed below the floor slab. Means for providing indirect waste connections are shown in Fig. 3.

The elevation of roughing featured in Fig. 6 is shown in Fig. 7.

Installation 1 of Fig. 7 shows a standpipe waste system installed above the floor slab. The piping shown is an indirect waste system if the rubber waste hoses from the laundry machines are inserted into the standpipes. This means that the waste piping must discharge into a drain, pit or sump pump arrangement that is properly trapped and vented. If the waste piping is to be a direct part of the sanitary system, the rubber hose must be indirectly connected to the standpipe and it must terminate above the standpipe.

Installation 2 illustrates the horizontal waste piping installed below the floor slab. All the indirect waste connections as defined in Installation 1, apply in this case.

Lint Interceptors

Some lint is discharged into the drainage system with the process of washing clothes in laundry machines. This lint can be troublesome when the waste is discharged into dry wells for it will impede the waste flow from the drywell to the soil. Many local codes require that the lint be intercepted to prevent its discharge into the exterior street sewer facilities. Different types of units are available for this with a wide range of sizes. Furthermore, they may be constructed of cast iron, steel or concrete.

Figure 8 shows a typical unit which can be used. The interceptor shown consists of a watertight concrete pit in which a fine mesh removable screen baffle is placed at an angle in the pit to offer a broader surface for intercepting the lint. The size of the pit is determined on the basis of the number of laundry machines involved. The cover is generally a steel plate secured in place with a gasket between the cover and frame. The sizing, placement and construction of the interceptor for lint must conform to local codes.

Hints for Effective Insulation

Much has been written on the economic amount of insulation, but little attention paid to what may be called "leaks" in insulation

WHENEVER A SPACE IS KEPT AT A TEMPERATURE other than that of its surroundings, some insulation is required. A reasonable understanding of the principles involved will result in better insulation, less moisture problems, and lowered costs.

Insulation is used for two principal reasons: (1) to reduce required capacity of heating or refrigeration and, hence, cost of operation; and (2) to avoid condensation where it is undesirable.

While much has been written on the economic amount or thickness of insulation, little attention has been paid to what may be called "leaks" in insulation. The uninsulated concrete floor that rests on the cork-insulated concrete wall of Fig. 1 illustrates a case in point.

In Fig. 1, overall resistance of the insulated wall, taking conductivities from the diagram, is

$$1/1.65 + 4/0.3 + 8/8.0 + 1/1.65$$
$$= 0.61 + 13.3 + 1.0 + 0.61$$
$$= 15.52 \text{ (hr) (sq ft) (deg F) per Btu,}$$

and the overall heat transfer coefficient is $1/15.52 = 0.066$ Btu per (hr) (sq ft) (deg F).

The floor, however, is a path of much lower resistance than the wall. It is a concrete slab whose area (exposed to room temperature) is very large compared to its thickness. Therefore it may be assumed that its temperature, at the point that it penetrates the wall insulation, is approximately equal to the room temperature. The effective length of this 8-inch wide (thermal) path from the exterior via the floor depends, in part, on the contact between floor and wall. If the contact is poor, the amount of heat transfer will be less, and the temperature at the edge of the floor will be closer to that of the room. Assuming zero heat transfer between wall and floor (the best condition), resistance of the floor is

$$(8 + 4)/8.0 + 1/1.65 = 1.5 + 0.61 = 2.11$$

and the overall transfer coefficient is 0.48, or about seven times that of the insulated wall.

Of course, the best way to eliminate the problem is

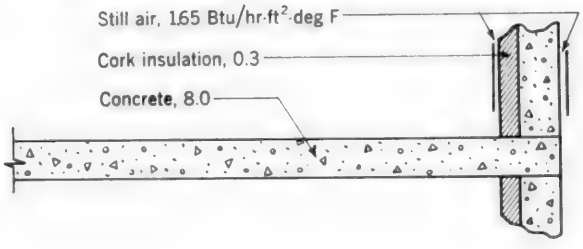


Fig. 1. Uninsulated concrete floor, resting on a cork-insulated wall, "leaks" heat. Depending on direction of heat, one side or the other will sweat.

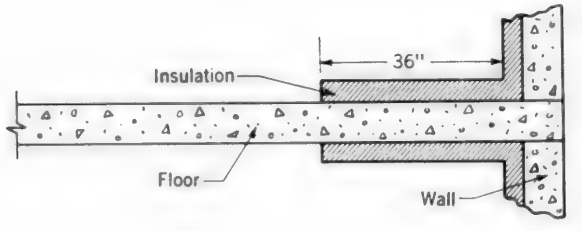


Fig. 2. Floor insulation is carried three feet into the room. Even so, resistance of floor to heat transmission is still only half that of the insulated wall.

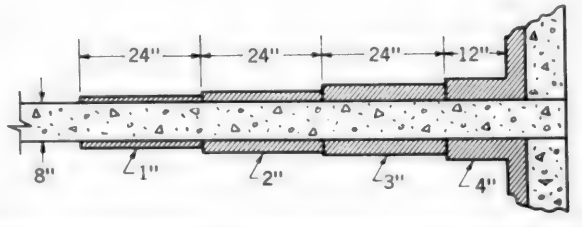


Fig. 3. Floor insulation is so arranged that resistance to flow of heat through any path in floor is approximately equal to a path through the wall. Only about one-third more insulation is required than in Fig. 2.

to put the 4-inch insulation on the outside of everything and, if the inside is always colder than the outside, have a good vapor barrier on the outside of the insulation. (The vapor barrier problem will be treated separately in a subsequent issue.)

It is often the practice to carry floor insulation 3 ft into the room, as in Fig. 2. Why 3 ft instead of 2 ft, or 4 ft, was chosen, isn't clear to me. With 3 ft of insulation, the floor's maximum resistance is $(8 + 4 + 36) / 8.0 + 1/1.65 = 6.61$, which is still less than half of the 15.52 for the insulated wall.

Figure 3 shows an arrangement for the insulation, such that the resistance of any path is about as high as that through the insulated wall. Only about one-third more cork is used than in Fig. 2. The Fig. 2 pattern will increase the chance of sweating at the floor on the cooler side.

Of course, insulation on the floor in the manner shown in Fig. 3 poses some problems, but the arrangement of Fig. 2 isn't much better. Again, this shows that every effort should be made to get the insulation on the outside or inside of a non-bearing outside wall so that the floor does not go through the insulation.

Condensation on Wall

A brewery in Argentina had three large fermentation rooms which were to be held at about 39 deg. Requirements had increased and a new air conditioner was built up on the floor above. The conditioner casing, fully insulated with 4-inch thick fiberglass with a proper vapor barrier, produced a differential of only about 2 deg in the temperature of the ouside surface of the air conditioner casing and that of the surrounding air when the difference between the surrounding air and the inside of the conditioner was 50 deg. Condensation could occur only if the dew point of the surrounding air were less than 2 deg below its temperature. Because so high a relative humidity was unlikely in the space where this conditioner is located, I was rather surprised to get a call advising me that condensation was occurring on the brick wall adjoining the conditioner. Upon inspection, I found the situation as indicated in Fig. 4. Condensation on the wall extended over a length about twice as long as covered by the conditioner on the other side and the pattern on the part opposite the conditioner was little different than the rest.

It was quite evident that heat was being transmitted to the fermentation rooms below. The condensation extended higher at the concrete columns because of its higher conductivity than that of brick. The condition indicated that the wall and columns continued uninsulated through the fermentation rooms on the floor below and a check proved this to be the case. Insulation should have been carried down the wall in the fermentation rooms in much the same manner as is indicated for the floor in Fig. 3.

Steel beams in the structure of cold rooms usually create a problem because the conductivity of steel is about 1000 times that of cork. Steel members projecting through insulation require very special treatment to avoid a serious heat leak. If the steel member is of very small cross section, so that heat leakage is of no importance while condensation is a problem, a little heat applied at the point where the steel projects through the insulation will take care of it. (Heat may be supplied by a strip heater, a steam or hot water pipe in contact with the beam or, as is commonly seen in connection with automobile windshields, by warm room air supplied by a fan.) Of course, this increases heat leakage into the cold room somewhat but, if the cross-section is small, it won't take much heat to raise the temperature of the member above the highest expected dew point just outside the insulation.

Necessary Connections Through Insulation

In some special cases a drive shaft or piping connection must pass through insulation, as in the following case: A low temperature chamber required a variable speed fan for air circulation. Any motor inside the chamber had to be explosion-proof. Since an explosion-proof motor for variable speed would require the supply of current at variable cycles or some other complicated arrangement, it was decided to install the motor outside and have a shaft pass through the insulation.

Interior chamber temperature was to be as low as −90 deg F. The outside was normal ambient, which would probably be around 75 deg. The difference be-

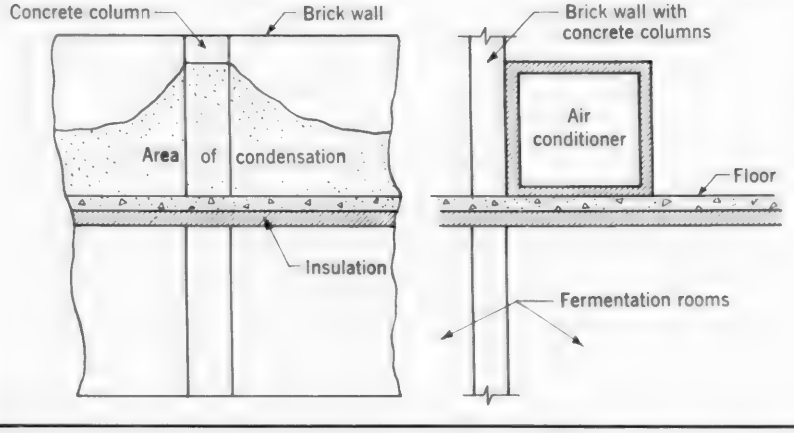


Fig. 4. How inadequate insulation caused troublesome condensation in Argentine brewery. Concrete columns "leaked" heat through insulation under floor above cold rooms.

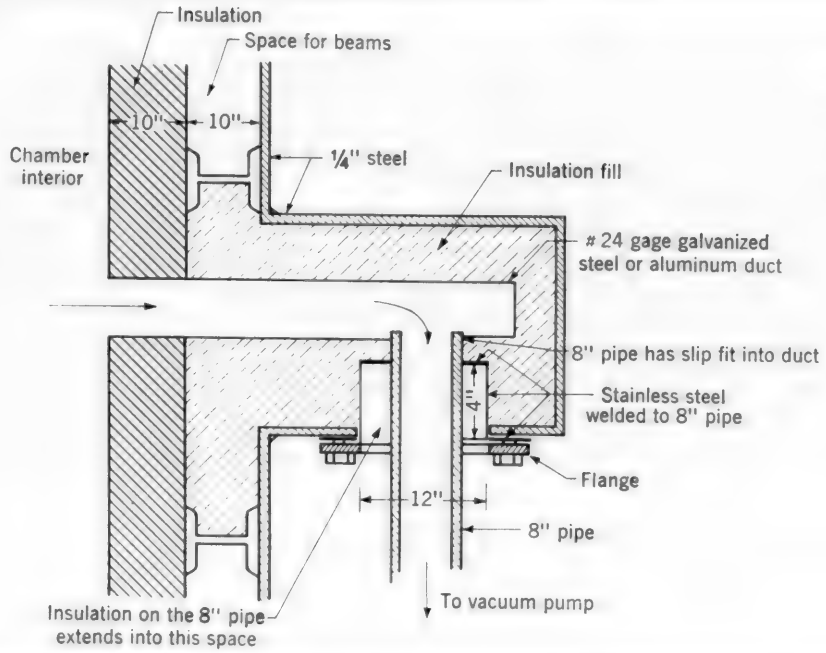


Fig. 5. One way to pass a metallic pipe through an insulated wall with negligible heat transfer through the pipe wall.

ing about 165 deg, insulation of about 10-inch thickness was used. This chamber was also used to simulate high altitudes and therefore has 12-inch steel beams and a ¼-inch steel shell outside the insulation.

The shaft could have been a 1¼-inch solid shaft; instead, a 3-inch dia tube was used. The 3-inch tube has less than half the cross-section of the solid shaft, with a corresponding effect on heat transmission.

Heat transmission was further reduced by using a stainless steel tube. Most stainless steels, being corrosion resistant, can be made of thinner walled tube, and in general have a conductivity about half that of regular steel. The result of using stainless tube was that the shaft outside the chamber was not noticeably colder than the outside ambient. A standard refrigerating compressor seal was used to seal the joint between shaft and chamber.

Low Transmission Metallic Connection

Probably the most interesting connection to the chamber was the 8-inch pipe connection through which air as low as −90 deg is evacuated to a pressure of about one psia. The joint between pipe and chamber casing must be tight, yet transmit little heat, because a cold casing would cause condensation and cause undesired stresses.

Such joints are often of the packed type, the packing doubling as an insulator. However, a fully metallic connection could provide a more dependable and desirable seal if such joint were made in such a way that it transmits heat at a very low rate. Fig. 5 shows a method of making such a joint.

Referring to Fig. 5, the duct is merely a guide for the cold air as it goes from the chamber to the 8-inch steel pipe. The pipe fits loosely into the duct as there is no value in a tight joint at this point.

A 1/32-inch stainless steel 12-inch OD annular disc, with an ID to match the OD of the 8-inch pipe, is welded to the pipe as shown. A 12-inch dia cylinder of 1/32 stainless steel is welded to the outer edge of the disc. Another annular disc of 12-inch ID and about 15-inch OD, is welded to the other end of the cylinder and this disc makes a tight joint with a gasket and the flange shown.

Stainless steel can be thin because it needs no corrosion allowance. With the joint made in this manner, pressure outside does not tend to collapse the stainless steel cylinder, so that extra thickness is not required to avoid collapse. All heat must pass through a minimum path 6 inches long and with a cross-section of less than 0.01 sq ft. With 180 deg difference between air in the 8-inch pipe and the air outside, the transfer is less than 40 Btu per hr. This amount of heat can be supplied by the ¼-inch casing with so little temperature difference as to be hardly noticeable.

If this small difference was of importance because of condensation possibilities, an electric heater of about 15 watts would supply the heat required to avoid having the temperature at the flange any lower than the rest of the shell. Such heater would be applied at the point where the stainless steel cylinder joins the disc at the flange.

The illustrations in this discussion show only a few problems connected with reduction of heat transfer and suggestions for their solution. There are many others. The attempt here is to illustrate the use of some basic principles to attain a practical solution.

Architects-Engineers' Office Employs Primary-Secondary Pumping

H. B. SWYGERT
Lyles, Bissett, Carlisle & Wolfe, Architects-Engineers
Columbia, South Carolina

IN ORDER TO MEET THE NEEDS for larger space requirements, the author's firm undertook the task of designing and constructing a new home office in Columbia, S.C. The building is 40 by 173 ft in size, and provides approximately 12,000 sq ft of floor space on two levels. The long wall facing north is constructed largely of tinted glass for reducing glare and for providing maximum natural lighting. The building, on the upper level, was designed to provide three conference rooms, administrative area, construction area, drafting area, and offices adjacent to drafting area for supervisory personnel. At the lower level is found additional room for overflow drafting, reproduction, blueprinting, storage and the mechanical equipment room. It is felt that the finalized floor plans provide efficient, adequate facilities for an architectural-engineering operation.

Design Considerations for Mechanical System

Building orientation and thermal demands by the building occupants dictate the limits to which the building must be zoned so as to obtain the greatest utilization of the heating, air conditioning and ventilating system. After a thorough analysis of the building, it was ascertained that a total of six individual zones would best suit the needs of anticipated building usage. The zones break down as follows: (1) main conference room, (2) private administrative offices, (3) north zone first floor, (4) south zone first floor, (5) north zone ground level, and (6) the air handling unit providing all outside air requirements.

In the initial planning stage the basic system must be settled upon. Will an air system be used or will a chilled water-hot water system best suit the application? In this instance a combination chilled water-hot water system employing fan-coil units and air handling units were decided upon for conditioning the various areas of the building. The architecture of the building and the lack of space for an all-air system made the water system a natural with its ability to cool in one zone and heat in another zone simultaneously.

Primary-Secondary Pumping

In order to provide simultaneous cooling and heating for different zones, a primary chilled water circuit and a primary hot water circuit were provided. Each of the individual secondary zone pumps was provided with three-way valves so as to permit circulation of chilled water or hot water, depending upon the position of a manual switch that controls the position of the three-way valves. The use of primary-secondary pumping offered these advantages:

1. The degree of control required for the individual zones.
2. Reduction in pump and piping sizes by permitting increased temperature drops with corresponding reduced water quantities.

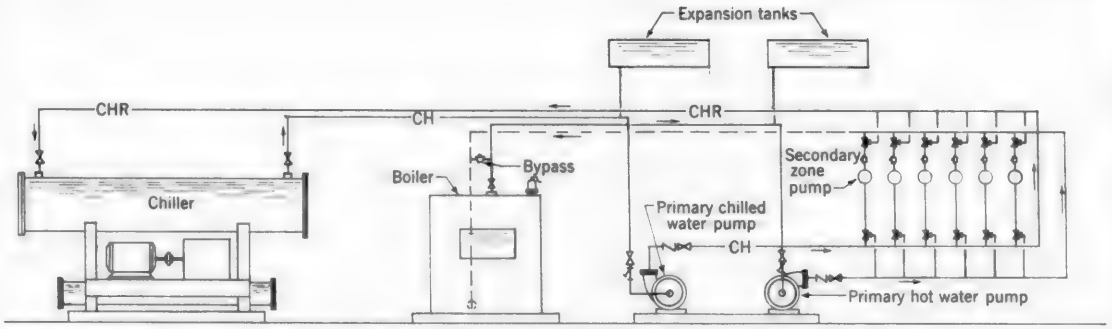


Diagram shows the two independent primary circuits: the hot water supply and return; and the chilled water supply (CH) and return (CHR). Each secondary circuit comprises a 3-way supply valve, zone pump, balancing valve, and 3-way return valve.

3. Reduced pump horsepower by utilizing two low-head pumps in lieu of a single, high-gpm, high-head pump.
4. Delivery of correct temperature cooling or heating media, in any amount, to any zone, at any required time.
5. Lower installation cost than a conventional system comprising more numerous and complicated controls.

A system of primary-secondary pumping is relatively simple in theory and practice provided certain elementary but necessary hydraulic precautions are taken. As can be seen from the diagram, two completely independent primary circuits were provided with secondary circuit pumps supplied from the required primary circuit. A dual-bulb outdoor-indoor controller varies the primary hot water circuit from a temperature of 70 deg F to approximately 150 deg. The temperature in the primary chilled water loop is set for 44 deg, and is controlled by a pneumatic modulating temperature controller located in the control panel on the chiller.

The major design considerations that must be borne in mind are:

1. Each individual primary circuit must be provided with its own expansion tank, in that the circuits are completely isolated from each other when all six zone pumps are supplied by the same primary circuit.
2. The total water quantity supplied by each primary pump must equal or slightly exceed the sum of the water quantities handled by the individual zone pumps.
3. Due to the increased quantity handled by the primary hot water pump, a manual by-pass is provided around the boiler to limit the flow rate through the boiler to a rate comparable to a 20-deg temperature rise. Excessive flow rates through the boiler may cause condensation on the fire side of the heating surfaces due to low water temperature; excessive pressure drop for primary pump; or excessive turbulence in the boiler tubes, which may cause decreased heat transfer.
4. Pumps should pump out of boiler to prevent pump cavitation, safety valve discharge and poor air venting.
5. Each secondary zone pump must be provided with individual balancing valves to assure that each pump is handling design water quantity without any of the zone pumps being starved.

Heating and Air Conditioning Equipment

A gas-fired copper tube hot water boiler and a reciprocating open-type direct expansion chiller produce the hot or chilled water as required. The water is then supplied by the above-described pumping system to (1) an air handling unit providing conditioned outside air to meet building needs; (2) an air handler providing conditioned air to the large conference room; and (3) to floor mounted fan-coil units conditioning the remainder of the building. All air to the air handling units is filtered by electrostatic air filters to help minimize the dirt problem encountered by being adjacent to heavy coal-smoke atmosphere.

Conclusion

It is worthwhile to note that the building has been completed and occupied since March of 1960, and much experience has been gained both from the building's physical arrangement and mechanical design.

The heating and air conditioning system has provided an environment in which the employees feel reasonably comfortable regardless of changes in outdoor weather conditions. The need has been proven on many occasions for both primary circuits, due to a demand for heating by five zones with the sixth zone, serving the conference room, requiring cooling. Certainly, adequate zoning with a chilled water-hot water system employing the primary-secondary pumping arrangement should be considered in the design of any building as a practical logical approach. Possible piping and zoning arrangements with primary-secondary pumping is limited only by the imagination and ingenuity of the engineer.

How to Keep Self-Contained Units Quiet In Apartment House Air Conditioning

ELECTRICALLY POWERED 3-ton air conditioning units are being considered for use in several large apartment buildings of reinforced concrete construction presently being designed by a Detroit, Mich. architect. If these units are selected, it is probable that they will be used in combination with electric space heating in individual apartments for year-round climatic control. The architect is also considering, instead, the use of absorption-type air conditioning equipment.

The Detroit Edison Company advises that, under normal marketing conditions, absorption-type air conditioners are higher in both first and operating costs—as compared with motor driven equipment. However, the suitability of mechanical air conditioning for use in the projected apartment buildings has been questioned. It is the contention of Detroit Edison that acceptable, vibration free, and silent performance can be realized with compressor-type units —if the latter are installed on properly designed vibration isolation mountings. A project was initiated by the company, therefore, for the following purposes: (1) to construct and evaluate a properly designed vibration isolation mounting for the proposed units, and (2) to evaluate the noise characteristics of the units and express an opinion regarding the probable noise level within the living quarters resulting from their operation.

The Detroit Edison report contains (1) a description of the vibration isolation mounting designed for the units, (2) the results of tests conducted to evaluate the effectiveness of the mounting in minimizing the transmission of vibration to surroundings representative of those that would exist in the projected apartment buildings, and (3) the conclusions of studies to predict the probable noise levels that would be prevalent within the living quarters and in certain other areas of the buildings due to operation of the equipment.

The isolation mounting tested at the laboratory provides a very effective reduction in the transmission of mechanical vibration from the air conditioner to the wall in which it is installed. If these units are installed on similar mountings in the projected apartment building, the transmission of vibration to the walls and floors of the building will be below the threshold level of sensory preception.

Results of acoustical studies indicate that the maximum noise level in any apartment will be less than the maximum acceptable noise level for sleeping quarters. (See Publication 706 of the Building Research Institute.) This fact has been further substantiated by model studies.

Figure 1 shows schematically the proposed arrangement of the air conditioning equipment in the apartment buildings. The air conditioners would be installed in openings in the walls of a 9-ft square shaft that extends vertically from an elevation about 18 ft above grade to the roof of the building. The walls of the shaft will be 6-inch thick reinforced concrete.

At each floor level, two apartments are arranged symmetrically about the shaft. The air conditioners serving the two apartments are to be installed at the same elevation in opposite walls of the shaft. The end of the unit that houses the condenser will protude into the shaft. The opposite end, housing the cooling coils, will extend into a small enclosure of the apartment called the "mechanical room," which is separated from the living quarters. Conditioned air from the unit is ducted from this location to the other areas of the apartment.

The shaft will be divided by a vertical partition as shown in Fig. 1. Outside air for condenser cooling

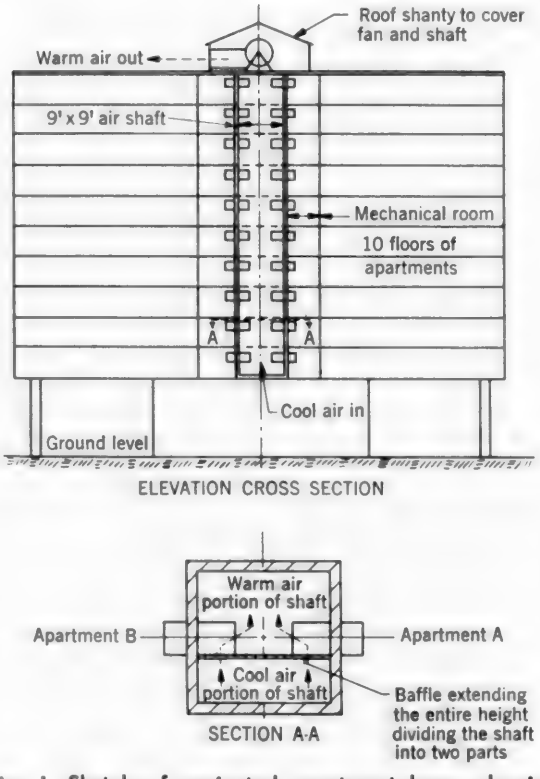


Fig. 1. Sketch of projected apartment house showing the proposed arrangement of the twenty air conditioners to be installed in one of the two air shafts.

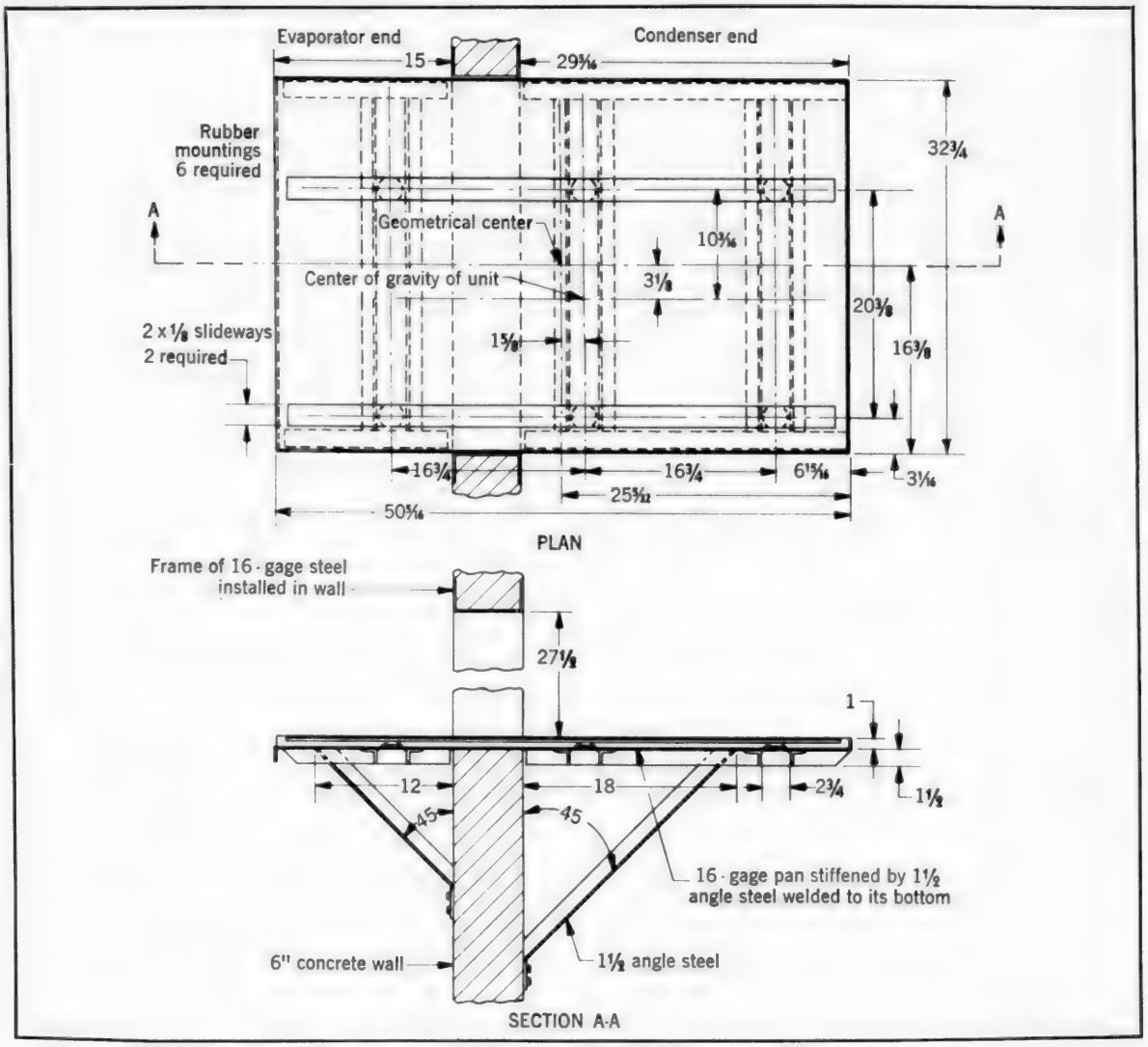


Fig. 2. Details of the mounting for the air conditioner.

Fig. 3. View of mounting for air conditioner. Flat bars, serving as slide-ways for unit, are insulated from mounting by six spring-and-rubber isolators.

will enter the units from one side of the partition and will exhaust to the opposite side and be drawn upward by an induced draft fan at the upper end of the shaft.

Figure 3 shows the vibration isolation mounting designed to support the air conditioner. Dimensions and details of the mounting are shown in Fig. 2. This mounting employs six (commercially available) rubber mountings symmetrically arranged about the center of gravity of the air conditioner. The three mountings on each side are connected by a ⅛ x 2-inch flat bar. The two flat bars serve as slide-ways to facilitate installation or removal of the unit from the mounting.

Details of procedures and results are available in the technical report of Detroit Edison's Research Department, 2000 Second Avenue, Detroit 25, Michigan.

NEW LITERATURE

Use the prepaid yellow postcard in the back of the magazine for securing your copies of these catalogs.

Schoolroom Systems

An 8-page manual describing gas-fired, forced air schoolroom heating and ventilating systems is announced by Norman Products Co., Columbus, Ohio, Div. of John J. Nesbitt, Inc. Presenting technical advantages, it also shows equipment for non-classroom areas.

Circle **Item 1** on Inquiry Card

Control Centers

The Johnson control center, called "nerve center" of the automatic temperature control system, is studied in a 4-page bulletin offered by Johnson Service Co., Milwaukee, Wis. Consisting of functional modules, unit centralizes data collection, motor control, and communications.

Circle **Item 2** on Inquiry Card

Check Valve

The Duo-Chek check valve, made by Mission Valve and Pump Co., a subsidiary of Mission Manufacturing Co., Houston, Tex., performs all regular check valve duties, yet is smaller, lighter and easier to install. A 10-page bulletin illustrates and describes this valve.

Circle **Item 3** on Inquiry Card

Unit Supplies and Exhausts Air

The Type P Twinalator, manufactured by Clarage Fan Co., Kalamazoo, Mich., provides both air supply and exhaust simultaneously. Four-page Bulletin 552 describes this unit, whose advantages include one motor, one opening, but unlimited applications. Capacity tables provided.

Circle **Item 4** on Inquiry Card

Gas Engines for Air Conditioning

Natural gas engines for air conditioning systems are manufactured by Waukesha Motor Co., Waukesha, Wis. Four-page Bulletin 1754 presents 17 reasons for this type of air conditioning power, and lists engine ratings. Applications include office buildings, shopping centers, schools.

Circle **Item 5** on Inquiry Card

Remote Room Conditioners

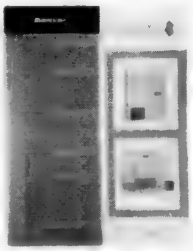
Fedair Type F remote room air conditioning units are described in 20-page Catalog HC-C7, available from Heating Div., Fedders Corp., Trenton, N. J. Various models of these fan-coil units are illustrated and described, and catalog includes engineering data, selection guide.

Circle **Item 6** on Inquiry Card

Cooling Towers

Bloomer cooling towers are described in a bulletin which is offered by Fiske Company, Chicago, Ill. Construction details and performance data are given for these units which are available from 5 through 550 tons in a single cell, in horizontal and vertical discharge models.

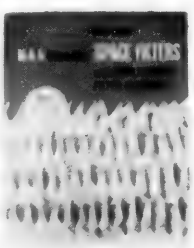
Circle **Item 7** on Inquiry Card



Gas Air Conditioning

An 8-page bulletin, offered by the Arkla Air Conditioning Corp., Little Rock, Ark., describes Arkla-Servel gas air conditioning. Equipment covered includes Sun Valley conditioners for year-round comfort; gas-fired water chiller-heaters; and steam-fired water chillers.

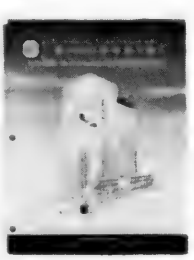
Circle **Item 8** on Inquiry Card



Space Filters

M-S-A Ultra-Aire space filters with replaceable filter elements are announced by Mine Safety Appliances Co., Pittsburgh, Pa. Their advantages, construction, sizes and shapes, installation and performance are the subject of an illustrated 8-page bulletin, No. 1505-5.

Circle **Item 9** on Inquiry Card



Sound Control Products

A complete line of air conditioning silencing products, tradenamed Aircoustat, is the subject of a 4-page bulletin offered by Sound Control Div., Koppers Company, Inc., Baltimore, Md. Products include sound traps, return air vent silencers, cooling tower and circular silencers.

Circle **Item 10** on Inquiry Card

Centrifugal Pumps

Two bulletins are announced by Hydrodynamics Div. — Chicago Pump, Food Machinery and Chemical Corp., Chicago, Ill. Eight-page Bulletin 107 describes its FC (flexible-coupled) centrifugal pump with mechanical seal; Bulletin 107-H, the FCP pump with packed stuffing box.

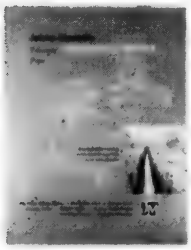
Circle **Item 11** on Inquiry Card

Refrigerant Compressors

The VMC multi-cylinder refrigerant compressor is featured in a 12-page bulletin offered by The Vilter Manufacturing Co., Milwaukee, Wis. Machine is available with V-belt drive or direct connected, and as part of self-contained condensing unit or packaged water chiller.

Circle **Item 12** on Inquiry Card

Use the prepaid yellow postcard in the back of the magazine for securing your copies of these catalogs.



Industrial Water Pipe

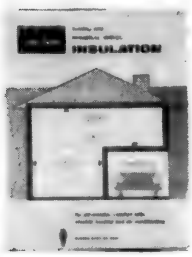
A 10-page brochure, TR-254A, is available from Johns-Manville, New York, N. Y., and describes Transite asbestos-cement industrial water pipe. Aimed at those concerned with the design of water systems for industrial plants, booklet includes much design and application data.

Circle **Item 13** on Inquiry Card

Ice Skating Rinks

A new booklet, Steel Pipe in Ice Skating Rinks, is offered by the Committee of Steel Pipe Producers, New York, N. Y. While 12-page booklet is written in "layman's" language, it is comprehensive enough to be of value to those designing both public and commercial rinks.

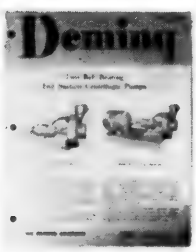
Circle **Item 14** on Inquiry Card



Mineral Wool Insulation

A 12-page manual offered by National Gypsum Co., Buffalo, N. Y., discusses the "R" factor in insulation and the All Weather Comfort Standard. Booklet shows how various insulation products should be specified and installed for maximum benefit.

Circle **Item 15** on Inquiry Card



End Suction Centrifugal Pump

The Deming Co., Salem, Ohio, announces a 4-page bulletin describing a new, low-cost centrifugal pump line. Bulletin 3913, reporting on the company's double-ball-bearing, end suction centrifugal pump, includes photos, performance tables and dimentional drawings.

Circle **Item 16** on Inquiry Card

Fan-Coil Units

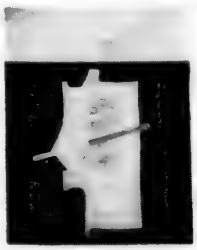
Seazonaire room air conditioning units, remote type, are the subject of 16-page Bulletin 35, published by Marlo Coil Co., St. Louis, Mo. Illustrated and described are various models of these fan-coil units, which provide individual room control of cooling, heating and ventilating.

Circle **Item 17** on Inquiry Card

Damper Control Hardware

A catalog of damper control hardware, tradenamed Ventlok, is offered by Ventfabrics, Inc., Chicago, Ill. Rapid development of high pressure duct systems, the company explains, has made necessary a specialized type of manual regulators and controls, such as described in catalog.

Circle **Item 18** on Inquiry Card



Fiber Glass Building Insulation

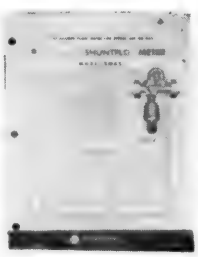
Year-round comfort and lifetime economy with fiber glass building insulation is the theme of a 10-page booklet available from Gustin-Bacon Mfg. Co., Kansas City, Mo. It covers insulation selection as to type and thickness, and insulation application and installation.

Circle **Item 19** on Inquiry Card

Polyethylene Pipe

Union Carbide Plastics Co., New York, N. Y., offers an 8-page bulletin, All About Polyethylene Pipe. It includes a highly-readable discussion of the properties, advantages, applications and installation procedures for this type of plastic pipe, and lists pertinent technical data.

Circle **Item 20** on Inquiry Card



Totalizing Flow Meter

The B-I-F Shuntflo meter, described as one of the most practical instruments available for the measurement of steam, gas or air in lines 1 inch and larger, where accurate accounting of flow is desired, is the subject of bulletin from B-I-F Industries, Inc., Providence, R. I.

Circle **Item 21** on Inquiry Card

Packaged Ventilating Fans

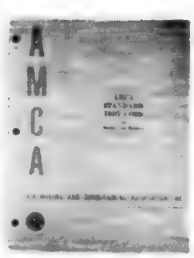
A new line of easy to install, packaged ventilating fans is described in 4-page Bulletin 1160 by Modine Manufacturing Co., Racine, Wis. It contains dimensional and performance charts for these fans developed for commercial, industrial and institutional buildings.

Circle **Item 22** on Inquiry Card

Atmospheric Gas-Fired Burners

A 14-page bulletin, No. H-1, issued by Combustion Div., Eclipse Fuel Engineering Co., Rockford, Ill., describes eight atmospheric gas-fired burners with maximum firing capacities from 10,000 to 2,750,000 Btu per hr. It includes dimensions, specifications and engineering data.

Circle **Item 23** on Inquiry Card

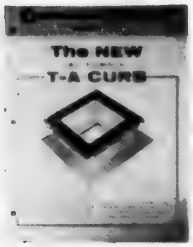


Test Code for Steam Unit Heaters

AMCA Bulletin No. 20, a new standard code for testing propeller-type steam unit heaters, is announced by Air Moving & Conditioning Association, Inc., Detroit, Mich. This revised code serves as a standard for performance ratings under AMCA Certified Ratings Program.

Circle **Item 24** on Inquiry Card

Use the prepaid yellow postcard in the back of the magazine for securing your copies of these catalogs.



Fan Mounting Curb

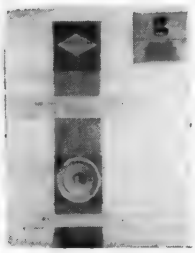
A 4-page bulletin describing its all-aluminum T-A (thermal-acoustic) curb, reported to assure trouble-free installation of roof exhaust fans, is available from Davidson Fan Co., Newton, Mass. Bulletin offers design advantages, dimensions, and typical specification.

Circle **Item 25** on Inquiry Card

ABS Plastic Pipe

ABS (acrylonitrile-butadiene-styrene) plastic pipe from Johns-Manville, New York, N. Y., is the subject of 4-page Bulletin TR-273A. Included are physical properties, rated working pressures, sizes and weights, and recommended method for joining this semi-rigid pipe.

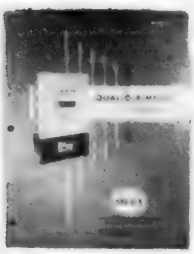
Circle **Item 26** on Inquiry Card



Air Distribution Products

General Air Products Corp., Stirling, N. J., announces Bulletin GEN-2-60 on its air distribution products. These products include grilles, registers, diffusers and accessories; features, sizes and prices are listed. Extruded aluminum grilles boast an architectural etched finish.

Circle **Item 27** on Inquiry Card



Combustion Indicator

Selas Corporation of America, Dresher, Pa., announces 8-page Bulletin Q-2 depicting its Qual-O-Rimeter combustion indicator, a continuous reading instrument which accurately indicates changes in flame characteristics caused by variations in the air/gas mixture.

Circle **Item 28** on Inquiry Card

Bonnetless Knife Gate Valve

Four-page Bulletin 301 describes and illustrates new bonnetless knife gate valve available from DeZurik Corp., Sartell, Minn. Valve is reported to be stronger, lighter, thinner and tighter, and to offer long life on corrosive and abrasive services. Accessories are also described.

Circle **Item 29** on Inquiry Card

Baseboard Radiation

Four-page Catalog BB-60 gives complete ratings, dimensional and working data for Model 485 baseboard radiation and accessories manufactured by The Rittling Corp., Buffalo, N. Y. Included is the company's new and silent roller bearing support for finned heating element.

Circle **Item 30** on Inquiry Card

Specialized Fabricated Equipment

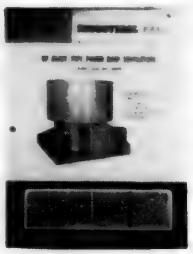
Specialized equipment for processing, plant operation, handling or storing can be designed and built by metal fabrication by Koven Fabricators, Inc., Dover, N. J. Eight-page Bulletin No. 550 describes this specialized equipment, including tanks, standpipes, piping and stacks.

Circle **Item 31** on Inquiry Card

Centrifugal Pumps

Horizontal split case centrifugal pumps, single stage and double suction, are the subject of 8-page Bulletin 105-C. Published by Aurora Pump Div., The New York Air Brake Co., Aurora, Ill., bulletin features comprehensive selection data and engineering information.

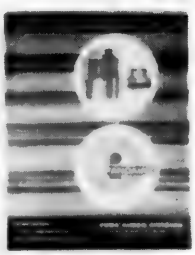
Circle **Item 32** on Inquiry Card



Industrial Fans

Industrial fans are the subject of new literature available from Reed Unit-Fans, Inc., New Orleans, La. Separate bulletins cover up-blast type power roof ventilators, mushroom type power roof ventilators, direct-drive and belt-drive tubeaxial fans, and exhaust fans.

Circle **Item 33** on Inquiry Card



Air-Cooled Condensing Units

Features of Fandaire air-cooled condensing units are discussed in a 4-page bulletin, available from Yuba Fandaire Div., Yuba Consolidated Industries, Inc., Tulsa, Okla. Condensers are available from 2 through 120 tons, and complete condensing units are available from 3—90 hp.

Circle **Item 34** on Inquiry Card

Plastic Exhaust Systems

Exhaust systems of corrosion resistant thermoplastics, manufactured by Industrial Plastic Fabricators, Inc., Norwood, Mass., are used by chemical processing, metals, textile and many other industries. System components, described in 4-page bulletin, include hoods, ducts, fans.

Circle **Item 35** on Inquiry Card

Control Valves

Control valves manufactured by Hubbell Corp., Mundelein, Ill., are illustrated and described in a 64-page condensed catalog. Products include solenoid valves, strainers, suction stop valves, back pressure regulators and others. Catalog contains selection, operating data.

Circle **Item 36** on Inquiry Card

Use the prepaid yellow postcard in the back of the magazine for securing your copies of these catalogs.

Electric Comfort Heating

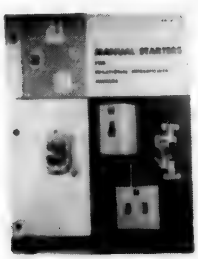
Chromalox electric comfort heating equipment is covered in 16-page Catalog 975-D by Edwin L. Wiegand Co., Pittsburgh, Pa. Valuable application and product information is presented for solving residential, commercial and industrial heating problems, including snow melting.

Circle **Item 37** on Inquiry Card

Industrial Heaters

A 12-page brochure providing complete information on the company's combination oil-gas line of industrial heaters is available from Lennox Industries Inc., Marshalltown, Iowa. Application information includes blower performance charts, specifications and ratings.

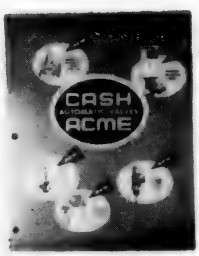
Circle **Item 38** on Inquiry Card



Manual Starters

Brochure 10-B1, published by Furnas Electric Co., Batavia, Ill., describes a complete line of manual starters for fractional horsepower motors. These devices are available as single and 2-pole units with built-in thermal relays to protect the motor from sustained overload.

Circle **Item 39** on Inquiry Card



Automatic Valves

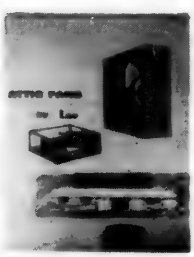
Automatic valves made by A. W. Cash Valve Mfg. Corp., Decatur, Ill., are illustrated and described in 12-page Condensed Catalog P&H-60. Equipment includes pressure-temperature relief valves, pressure relief valves, pressure reducing and regulating valves, zoning valves.

Circle **Item 40** on Inquiry Card

Regenerative Turbine Pumps

Catalog Section 101 contains complete engineering data on regenerative centrifugal turbine pumps, designed for industrial service by Turbine Pump Div., Roy E. Roth Co., Rock Island, Ill. The 12-page catalog includes performance and selection data, plus dimensions.

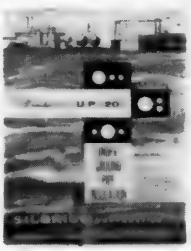
Circle **Item 41** on Inquiry Card



Attic Fans

An informative section on proper selection, according to geographic location, and installation of attic fans is part of a 12-page bulletin describing Niteair attic fans. Manufacturer, The Lau Blower Co., Dayton, Ohio, offers this well-illustrated bulletin.

Circle **Item 42** on Inquiry Card



Underground Pipe Insulation

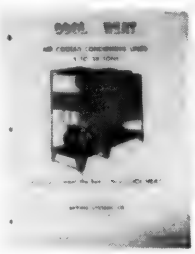
Underground pipe insulation, designated All Weather Crete U.P.-20, is described in 4-page bulletin from Silbrico Corp., Chicago, Ill. This insulation is a thermo-setting monolithic conduit which requires no curing and contains no water. Application data are included.

Circle **Item 43** on Inquiry Card

Heat Pumps

Described as the only complete heat pump line, packaged units in sizes up to 75 tons are manufactured by Typhoon Heat Pump Div., Hupp Corp., Tampa, Fla. A 6-page bulletin illustrates commercial and residential water-to-air units, and heavy duty air-to-air models.

Circle **Item 44** on Inquiry Card



Air-Cooled Condensing Units

Two bulletins are offered by Drying Systems Co., Chicago, Ill., Div. of Thor Power Tool Co. One bulletin describes Cool Heat air-cooled condensing units, in 5 to 30 ton sizes; the other covers compressed air dryers, for completely automatic drying of compressed air lines.

Circle **Item 45** on Inquiry Card

Refrigeration Specialties

Condensed Catalog No. 58, available from Sporlan Valve Co., St. Louis, Mo., describes its "peak performance products." These include thermostatic expansion valves, solenoid valves, refrigerant distributors, strainers, filter-driers, moisture-liquid indicator, liquid level control.

Circle **Item 46** on Inquiry Card

Rotary Positive Blowers

A 12-page bulletin (S88-A) telling how Series 88 rotary positive displacement blowers provide constant metered quantities of gas or air, even against varying pressures, is available from Sutorbilt Corp., Compton, Calif. Dimensional charts and drawings are included.

Circle **Item 47** on Inquiry Card

Powdered Acid Cleaner

Hagan powdered acid cleaner, for use in cleaning scale deposits from boilers, heat exchangers, water lines, pumps and other equipment, is the subject of 4-page Bulletin HSP-940. Published by Hagan Chemicals & Controls, Inc., Pittsburgh, Pa., it shows methods for using cleaner.

Circle **Item 48** on Inquiry Card

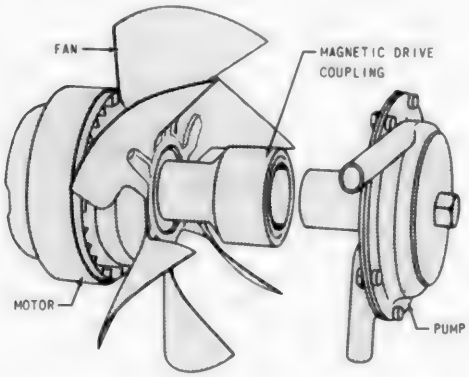
NEWS OF EQUIPMENT AND MATERIALS

Use the convenient prepaid yellow postcard in the back of the magazine for securing more information about new equipment and materials described in this department.

Hydronic Heater Includes Pump

What is reported to be a major step forward in the field of hydronics is announced by Thermal Specialties Div., Iron Fireman Mfg. Co., Cleveland, Ohio. Its research and engineering lab has developed and perfected a unique hot water unit heater—now in the test market stage—which can operate off the same tank that supplies hot water for baths, laundry and dishes (local codes permitting).

A key feature of this new heater is that it houses, or contains, its own water pump. Heater is a simple, compact unit designed chiefly to provide supplemental heat for "hard-to-heat" rooms or to heat added-on areas—and at substantially below the cost of comparable heating units. These heaters can also be used to heat an entire structure.



This heater requires only three simple steps for installation: Just pipe it to a hot water source fired by oil, gas, coal or wood, plug the provided 8-ft extension cord into an electrical outlet, and connect the low-voltage thermostat.

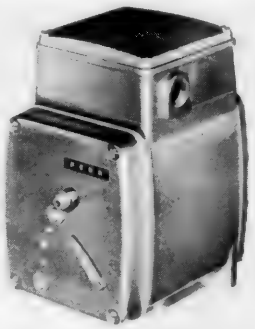
Heart of this development is a ceramic magnetic drive which now makes it practical to produce a hot water unit heater with its own circulating pump and a small motor. Since the pump impeller is driven by the motor via magnetic coupling, there are no water seals and, consequently, no high friction power requirements to drive the pump.

According to the company, heater is the first self-contained, complete hydronic package that circulates hot water through the unit, and filters and distributes temperature-controlled warm air. A single motor (small 3-speed, tap winding, shaded pole type) drives both the fan and the water circulating pump. Because there are no seals, the pump cannot leak. It will safely withstand, and operate on, any city water pressure up to 200 psi.

More Information? Circle Item 49 on Inquiry Card.

New Line of Motor Actuators

A new line of motor actuators for positioning air damper, control valves, programming devices, burner fuel valves and similar equipment is announced by Penn Controls, Inc., Goshen, Indiana.



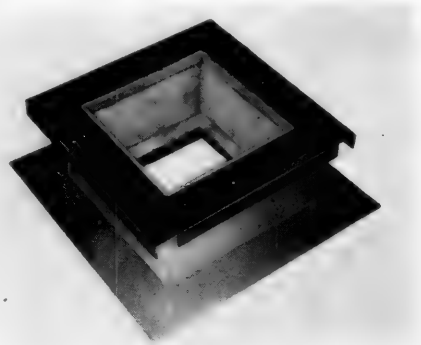
Described as precision-crafted, exceptionally quiet and attractively finished in grey hammerloid baked enamel, Type MA motor actuators are available in a wide variety of models for use with various types of electrical control devices such as push button stations, slide wire-type temperature or pressure controls, and bridge circuits used with electronic controls.

Models are available with various operating speeds and output torques to suit practically every known application. Models are also available which incorporate an additional balancing potentiometer for the simultaneous operation of a second motor actuator.

More Information? Circle Item 50 on Inquiry Card.

Roof Exhaust Fan Curb

Announced by Davidson Fan Co., Newton, Mass., is the all-aluminum T-A (thermal-acoustic) roof exhaust fan curb. Eliminating improvised field construction for installing roof exhaust fans, the curb is reported to assure a perfect fit every time.



A special deep mounting flange allows flexibility for inserting the curb in roof opening. Welded construction eliminates joints that could loosen, and strong fastening flange is provided for duct connection. Spun glass fiber insulation absorbs noise and reduces reverberation.

More Information? Circle Item 51 on Inquiry Card.

(Continued on page 111)

McQuay

air conditioning equipment

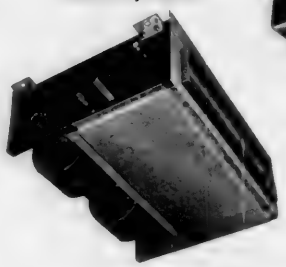
Including the New Single and Multi-Zone Air Handling

McQuay Means Quality

McQuay

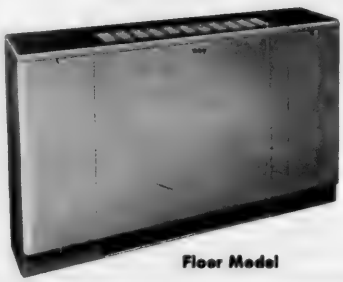
SEASONMAKERS

McQuay offers the finest in remote type, individual room air conditioners for use with a central station heating and cooling system. Extremely quiet, the "Seasonmaker" is available in floor, basic, ceiling and hideaway models in a wide range of sizes to meet your exact requirements. Floor and basic models range from 220 to 1240 cfm, and ceiling and hideaway models range from 220 to 640 cfm. Write for catalog 715.

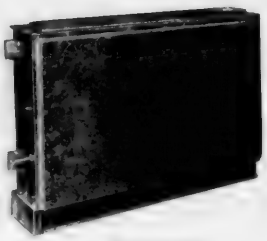


Hideaway Model

Ceiling Model



Floor Model



Basic Model

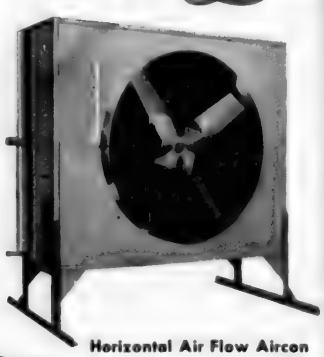
LARGE CAPACITY SEASONMAKERS

5 TO 15 TONS CAPACITY

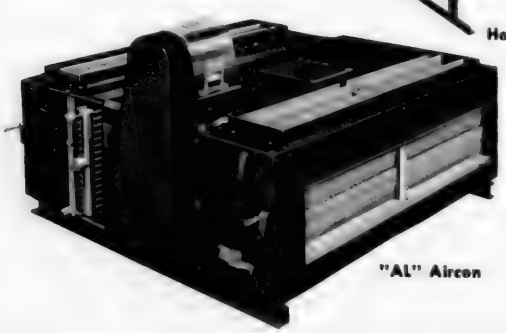
Remote type ceiling suspended air conditioners for medium to large areas. Designed for fully recessed closet and false ceiling installations, or horizontally suspended in the conditioned space. The quiet, attractively styled McQuay large capacity "Seasonmaker" is available in four sizes of direct drive and five belt driven models. Write for catalogs 722 and 730.

McQuay

Vertical Air Flow Aircon



Horizontal Air Flow Aircon



"AL" Aircon

REMOTE TYPE AIR COOLED CONDENSERS

"AB" AIRCONS—Propeller fan types available in either horizontal or vertical air flow. Thirteen sizes each from 8 to 85 tons nominal capacity. Multiple installations make capacity unlimited. Write for catalog 629.

"AL" AIRCONS—Centrifugal fan types are designed for outdoor or indoor installations with or without duct work. They may also be used for exhaust ventilation and heating. Compactly engineered with a low silhouette, there is a wide range of unit and fan discharge arrangements. Write for catalog 635.

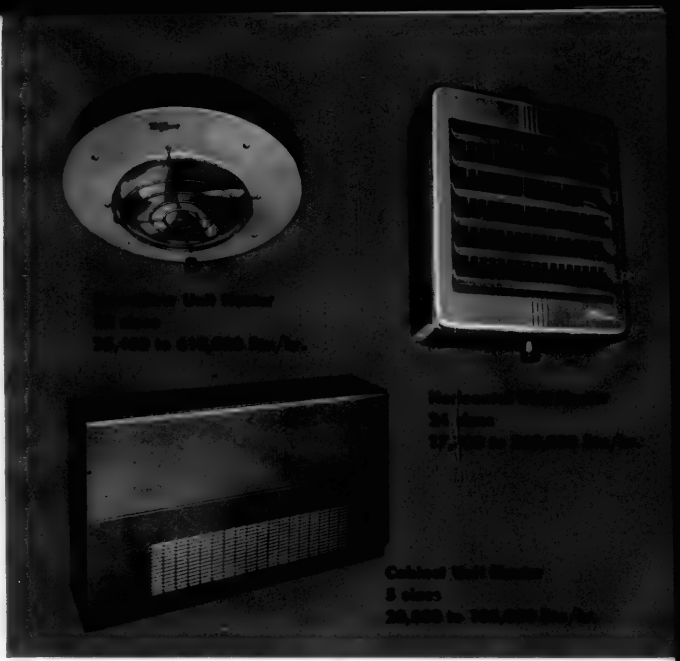
AUTOMATIC HEAD PRESSURE CONTROL

The McQuay type "AB" and "AL" Aircons are available with air side and refrigerant side head pressure control. The "AB" line is offered with opposed blade face dampers and corresponding controls for automatic operation.

McQuay

UNIT HEATERS

Horizontal, downflow and cabinet type unit heaters are available in an exceptionally wide range of sizes and capacities for either steam or hot water. Adjustable louvers and several varied styles of air deflectors are available. McQuay cabinet type unit heaters are available for floor, wall and ceiling applications; for exposed, semi-recessed or fully recessed installations. Write for horizontal unit heater catalog 323, downflow unit heater catalog 765, cabinet unit heater catalog 351.



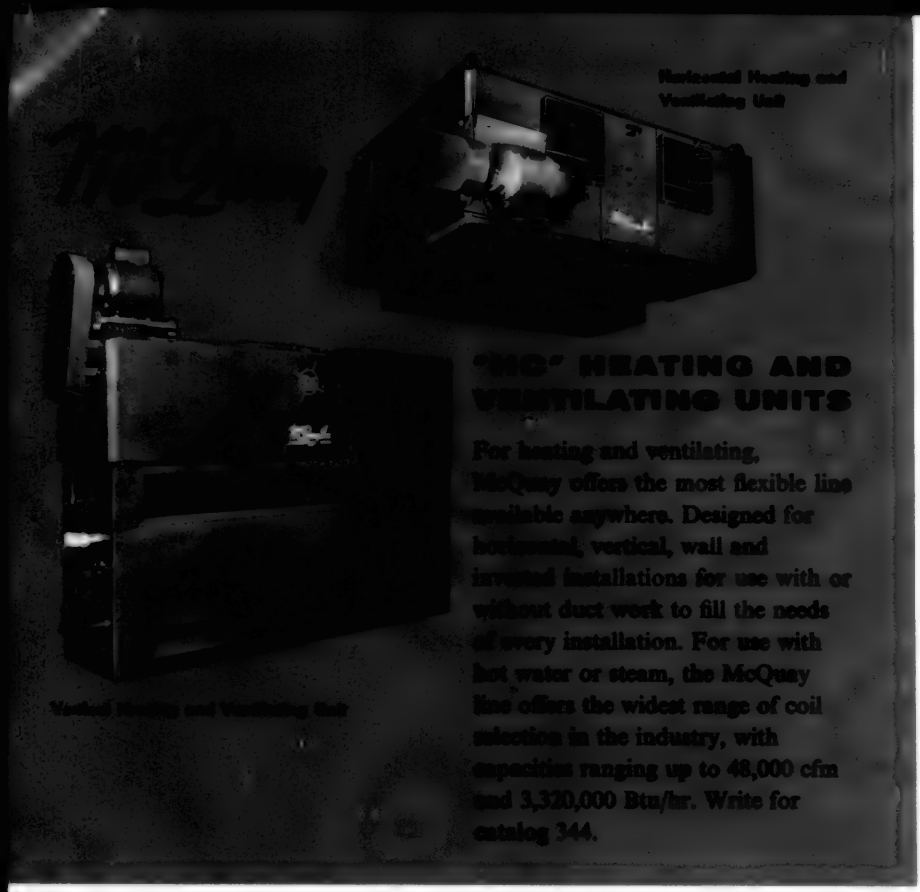
McQuay

SEASONMASTERS

SINGLE AND MULTI-ZONE CENTRAL STATION AIR CONDITIONING UNITS

McQuay proudly offers a completely new line of quality engineered central station air conditioning units. A new space saving design, available in both single zone draw through and multi-zone or double duct blow through arrangements in low pressure (up to 3" s.p.) and medium pressure (3" to 5½" s.p.), makes the McQuay line the most complete and versatile throughout the industry. Twenty-four models with multiple coil sizes insure the proper fan and coil combinations for every requirement. A full line of accessories is available. Write for catalog 560.

Vertical Seasonmaster



Horizontal Heating and Ventilating Unit

Vertical Heating and Ventilating Unit

"MC" HEATING AND VENTILATING UNITS

For heating and ventilating, McQuay offers the most flexible line available anywhere. Designed for horizontal, vertical, wall and inverted installations for use with or without duct work to fill the needs of every installation. For use with hot water or steam, the McQuay line offers the widest range of coil selection in the industry, with capacities ranging up to 48,000 cfm and 3,320,000 Btu/hr. Write for catalog 344.

McQuay

SEASONVENT

The McQuay Seasonvent is a deluxe large capacity heating and ventilating unit engineered specifically for school auditoriums, theatres and similar installations where quiet operation is a necessity. The Seasonvent is extremely versatile with nine sizes for low static applications (0" to 1¼" s.p.) and seven sizes for high static installations (1" to 2" s.p.), with capacities from 1250 to 15,000 cfm. Write for catalog 575.

McQuay

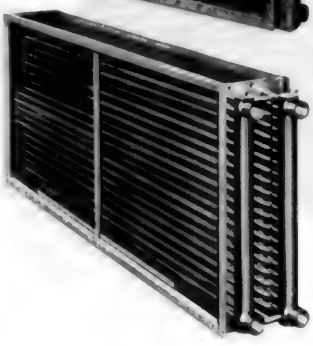
RIPPLE-FIN COILS

By the Nation's Largest Coil Manufacturer

A new type "5" coil design with a wide range of available fin spacings offers unlimited selection to meet all load requirements. This new design affords a new high in fin efficiency by attaining the highest heat transfer rate possible without excessive air friction. The combination of equilaterally staggered tubes and modified rippled fins produces maximum air turbulence, and intimate and prolonged contact between air and heat exchanger surface.

Direct expansion coils with pressure type distributors.

Pitched in casing steam coils. Easy installation and positive condensate draining.



Flow circuited water cooling and heating coils.

McQUAY, INC., 1600 Broadway N.E., Minneapolis 13, Minnesota

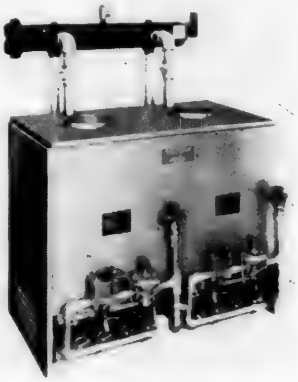
McQuay INC.

AIR CONDITIONING • HEATING • REFRIGERATION

DM—1961-2 Printed in U.S.A.

Water Heater for Laundries

Hydrotherm, Inc., Northvale, N. J., manufacturer of gas-fired hot water boilers, announces its Laundro-Temp hot water heating plant. The new boiler is a compact, heavy-duty unit designed especially for the rugged requirements of self-service and commercial laundries, and features a 10-year guarantee against corrosion and burnout.

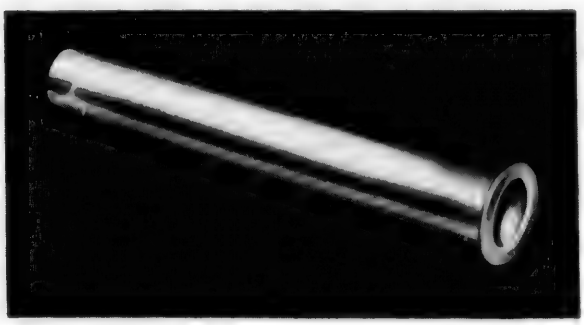


For the first time, the company reports, long-life cast-iron construction has been combined with a factory engineered all-copper heat exchanger directly flanged to the boiler and efficiently heated by thermo-siphon effect. Boiler and heat exchanger are rated for 100-psi ASME working pressure, thus permitting direct connection to city water lines, and eliminating the need for pressure reducing valves and expansion tanks.

More Information? Circle Item 52 on Inquiry Card.

Flexible Polyethylene Inserts

Flexible polyethylene inserts, called Alkaserts, for new and used steam condenser tubes are reported to greatly prolong condenser tube life. Preventing inlet erosion and impingement attack, the Alkaserts are



available from Tennant Development Corp., New York, N.Y., in two styles: Standard, for new condenser tubes, and Expanded, for used tubes.

Inserts are quickly and easily installed, being merely push-fitted into tubes, and they require no adhesive to keep them in position. They are dimensionally stable to 157 deg F—well above normal operating temperature of a steam condenser.

More Information? Circle Item 53 on Inquiry Card.

Registers and Grilles

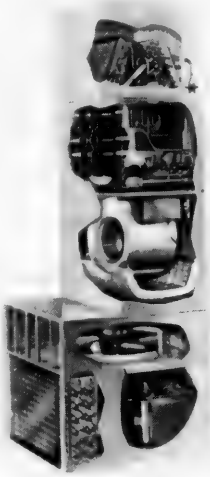
Hart & Cooley Mfg. Co., Holland, Mich., announces a line of registers and grilles made exclusively of extruded aluminum. It is said that the line is complete and provides every directional air flow and volume control to suit both domestic and commercial air conditioning requirements.

Extruded aluminum, it is pointed out, is superior to ordinary rolled aluminum in that it is much stronger, more rigid and far less susceptible to damage. These registers and grilles are not subject to rusting, pitting or corrosion, even where subjected to salt air.

More Information? Circle Item 54 on Inquiry Card.

All-Season Package for Apartments

Lennox Industries Inc., Marshalltown, Iowa, announces a heating-cooling package for apartments and small commercial applications. All the equipment, including gas furnace, cooling coil and air-cooled condensing unit, fits within a 36 x 36-inch closet. It provides complete, ducted all-season comfort conditioning for an apartment, with individual control for that apartment.



Installed, the air handling face of the condensing unit extends through an outside wall and is flush with the outer wall surface. The part of the condensing unit that remains in the closet becomes the base for the furnace. The cooling coil is mounted on top of the furnace. Completely assembled, the unit requires only 89 inches of headroom. Trunk duct is taken off the side of the cooling coil cabinet. This cabinet can even be trimmed down another four inches if desired. Return air can be brought back between floor joists or through grilles in closet walls.

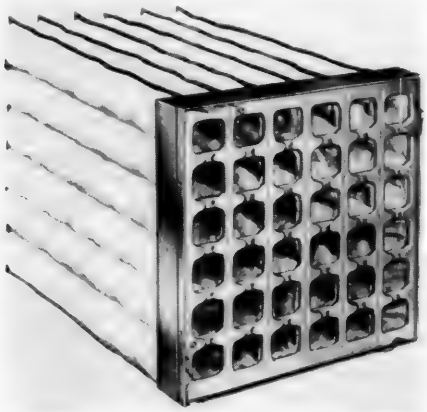
Unit provides a nominal two tons of cooling and 51,000 Btuh input of heating (all gases). For convenience the furnace can face either right or left.

A new refrigerant circuiting method in the large four-row condenser coil increases the amount of refrigerant sub-cooling, according to the firm. It is claimed this improves Btu per watt performance because the liquid refrigerant reaches the evaporator coil up to 20 deg F cooler than the condensing temperature.

More Information? Circle Item 55 on Inquiry Card.

Inflatable Air Filter

A dry-type air filter, called DRI-Pak, is introduced by American Air Filter Co., Inc., Louisville, Ky., to answer the demand for a unit filter of high efficiency, low resistance, compactness and unusual dust-holding capacity. The filter provides air cleaning efficiencies as high as 97%, based on the National Bureau of Standards dust spot method on atmospheric dust, and is said to be ideal for use in industrial and commercial ventilating systems, or in central air conditioning systems.



The filter is unique in that it inflates when the ventilation system is in operation and collapses when the system is shut down. With this feature, the unit can be inspected and serviced from either the air-entering or air-leaving side of the filter bank. Since no back-up wire grid is necessary, chances of damaging the filter during installation have been greatly reduced.

Filter is disposable, extremely light in weight, and requires little storage space. Each 24 x 24-inch cartridge in the folded state is only 4 inches deep and weighs just 4 lb. Compact cartoning of the DRI-Pak in a folded state also eliminates the need for large access doors and permits easy corner turns. After the unit has reached final resistance, the cartridge, including the header, is thrown away.

More Information? Circle Item 56 on Inquiry Card.

Heats, Ventilates Large Areas

The Trane Company, La Crosse, Wis., announces that its "Torrivent" line—for heating and ventilating large areas such as school auditoriums, gymnasiums, commercial and industrial buildings—now includes 102 standard units. Line now comprises 17 basic sizes with heating capacities from 20,000 to 3,800,000 Btu and air capacities from 600 to 54,000 cfm.

Six models—horizontal ceiling, horizontal floor, vertical floor, vertical wall, inverted ceiling and inverted wall—allow the units to be adapted to a greater number of installation sites throughout the building.

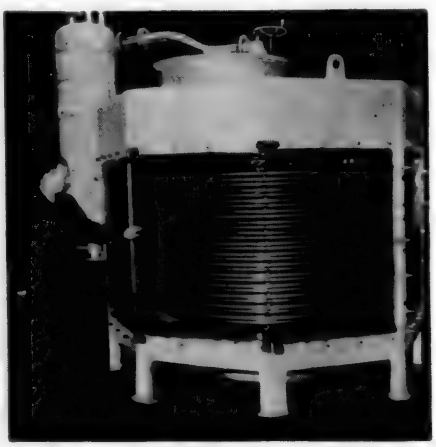
Sectional construction affords further flexibility, the firm reports. This construction makes possible a step by step selection procedure of: 1) casing and fan section, 2) steam or hot water coils and, 3) accessories—filters, face and bypass dampers, mixing boxes, nozzles, discharge and return air plenums, wall intake boxes, humidifiers and vibration isolators. This selection method allows the unit to be tailored exactly to present and future building needs.

More Information? Circle Item 57 on Inquiry Card.

Exhaust Gas Boiler

What is described as an advanced design exhaust gas boiler system, with the brand name of Sanea, is introduced in this country by Pacific Overseas Machinery, Inc., Beverly Hills, Calif. The boiler system is available in a range of standard sizes, from 1100 to 6100 lb per hr steam, and can be furnished in larger models to meet specific customer requirements.

The waste heat boiler is specifically designed for use with exhaust heat from diesel engines, heating furnaces and gas turbines. Because of the efficient design of the heating coils, this device demonstrates a 10% increase in operating efficiency over conventional exhaust boilers, according to the Swedish manufacturer.



Heart of the system consists of a series of helical tube coils arranged in parallel rows inside the unit. Inlet and outlet ends are connected to the distributing and collecting headers. The headers are connected in series to a steam drum or to a boiler and circulating pump. Thus the heat absorbing boiler water is circulated through the helical tube coils and steam separation occurs in the steam drum or in the connected boiler. Exhaust gas from the heat source is led from below into the boiler, where it then passes radially over the coils into the surrounding casing and then to the exhaust outlet.

More Information? Circle Item 58 on Inquiry Card.

New, compact
COMMERCIAL
ECONOMY
PACKAGE

IRON FIREMAN
WhirlPower
TRADE MARK
HEAT GENERATOR
gas, oil or dual-fuel

Generates MORE heat and uses LESS fuel

Makes a clean flame . . . by eliminating smoke and soot. The new, unique, forced draft WhirlPower burner achieves total combustion within the fire-cone itself. It starts clean and stays clean.

Sealed combustion chamber . . . Complete control of both fuel and air means 100% combustion and the sealed system eliminates one of the principal causes of heat loss—cold air infiltration.

Surrounds the fire with boiler water . . . for immediate, radiant absorption of heat. No refractory sidewalls to separate the flame from the heating surfaces and store and dissipate heat when burner is "off".

Cuts standby loss . . . during "off" periods by restricting the passage of air through the burner and boiler. Heat is retained in the boiler—not lost up the chimney.

Controls the air supply . . . the entire air supply is introduced through the firing port under forced draft in a sealed system. WhirlPower generator does not depend upon unpredictable natural draft. It needs no chimney; simply an exhaust vent. (Local codes permitting). Operates equally well with chimney.

A complete package. The WhirlPower heating package is a completely assembled, factory wired and tested unit, ready for service connections. Boiler and burner can be shipped separately if desired.

Compact. Cuts headroom needed—compared with old-fashioned boilers—as much as 3 feet. With its compact size comes efficiency and exceptionally high heat production—and substantial savings in installation, fuel, service and maintenance costs.

Mail coupon for full information and specifications

IRON FIREMAN

HEATING AND AIR CONDITIONING
AIRCRAFT COMPONENTS AND EQUIPMENT
MISSILE AND AIRCRAFT GYROSCOPES
ELECTRONIC EQUIPMENT
CONTROL INSTRUMENTS

Iron Fireman Mfg. Co., 3128 W. 106th St., Cleveland 11, Ohio
(In Canada, 80 Ward St., Toronto)

Please send full information and specifications on Iron Fireman WhirlPower Heating Package.

Name_____

Address_____

City_____ State or Prov._____

For more data circle this page number on card at back of book

Air Diffuser for Troffers

An air diffuser for troffers, which permits coordination of air distribution and illumination in a single efficient ceiling unit of pleasing appearance, is available from Anemostat Corporation of America, New York, N. Y.

The integral parts of the combination unit are two separate products. The Type CLD air diffuser is purchased from Anemostat, and the air handling troffer

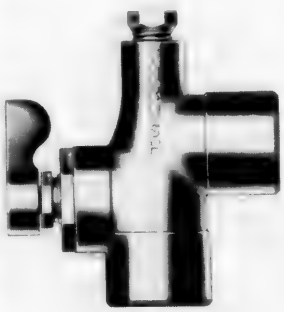
from whichever leading troffer manufacturer is selected. These units are separately installed by the mechanical and the electrical contractor. They have been designed for separate installation to avoid conflict of trades.

The CLD air diffuser is of the aspirating type, and discharges the supply air at acceptable sound levels without smudging, it is disclosed.

More Information? Circle Item 59 on Inquiry Card.

Balancing, Venting Elbow

H. A. Thrush & Co., Peru, Ind., announces its Balancing Vent Ell—a triple-functioning fitting that is an elbow with a vent chamber, and also a diverter to change the rate of flow through the fitting.



Unit is designed so that it can be installed inside baseboard covers for easily accessible balancing and venting of the baseboard radiation on main-less or one-pipe systems. It can also be used with convectors, unit heaters and radiators. Unit may also be installed with the vent chamber pointing down to act as a drain, rather than a vent.

Since the handle on the outside of the fitting is always in the same position as the diverter within, the amount of resistance set up by the brass diverter can readily be seen.

More Information? Circle Item 60 on Inquiry Card.

Motorized Damper Operator

A new motorized damper operator, said to have outstanding benefits due to an entirely new principle, has been developed by Automatic Timing & Controls, Inc., King of Prussia, Pa.

The ATC operator is applied to secondary air service and mounts directly on the damper shaft. It eliminates the need for linkages and special brackets. Advantages of this type of motorized damper installation can be measured in terms of boiler operation efficiency, extended life of boiler components and reduced maintenance costs. Perhaps of more important economic value, labor savings on power plant installations are realized because a battery of damper operators, such as are employed on secondary air dampers, can be quickly made at remote locations by gage selector switches on the instrument control panel.

More Information? Circle Item 61 on Inquiry Card.

Heat Exchanger Cools Blood

During open heart surgery, this small, compact heat exchanger cools the patient's blood to a temperature considered safer by surgeons. It is used only once, but saves money compared with permanent types.

According to material supplier, Armco Steel Corp., Middletown, Ohio, the high tensile strength of Armco 18-8 stainless steel makes possible the use of .005-inch thick core walls, and the thin-gage metal makes the unit more efficient. Case and tubes are also stainless steel, which means that the heat exchanger is sterile and pyrogen-free, and will not corrode in storage.

The unit, a product of Surgical Instrument Co., Baltimore, Md., is reported to cost less than a half-pint of blood, and about one-twentieth as much as the least expensive of non-disposable exchangers. It weighs 7 ounces as compared to about 25 pounds for a permanent type. Core of the heat exchanger is shown at left in photo; at right is a cut-away showing core in place in the stainless steel case.

More Information? Circle Item 62 on Inquiry Card.

PPG Fiber Glass Pipe Insulation is slit lengthwise, slips easily on to pipe. Delaware Insulation Company installed 15,000 ft of PPG Pipe Insulation in the new Wilmington High School, reported excellent working characteristics.

"We can install PPG Fiber Glass Pipe Insulation 15% faster than other pipe insulating materials"

says Mr. Anthony Kotowski, foreman, Delaware Insulation Company, Wilmington, Delaware

"A good worker can insulate 200 feet of pipe in one work day. But with PPG Pipe Insulation, he can insulate 230 feet in the same amount of time," reports Mr. Kotowski. "This helps us maintain tight construction schedules and saves money, too!

"We like PPG Fiber Glass Pipe Insulation because it's flexible and workable. We bend it around pipe hangers, mold it to shape easily, smooth it, then fasten and bind it," continued Mr. Kotowski as he discussed the PPG installation in a Wilmington High School. "You can't do that with other insulations. They're too brittle, require cutting, and sometimes break when you're working with them.

"PPG Pipe Insulation is easy on the hands, and it's not attacked by rodents. Of all the insulations on the market, PPG gives the neatest, quickest job."

GET TOP RESULTS WITH PPG

Fast installation, excellent thermal insulation, long service life, low maintenance . . . all these advantages are yours with PPG Fiber Glass Pipe Insulation. It's available in a full range of sizes, with or without facing.

For full information, contact your nearest PPG Fiber Glass Sales Office, or write *Pittsburgh Plate Glass Company, Fiber Glass Division, One Gateway Center, Pittsburgh 22, Penna.*

FIBER PPG GLASS

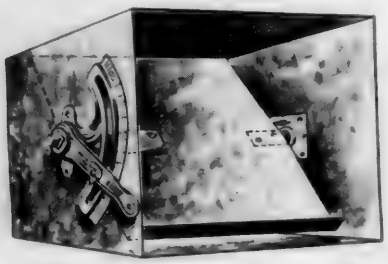
PITTSBURGH PLATE GLASS COMPANY

Sales Offices: Atlanta, Boston, Buffalo, Charlotte, Chicago, Cincinnati, Cleveland, Dallas, Denver, Detroit, Houston, Kansas City, Louisville, Los Angeles, Miami, Milwaukee, Minneapolis, New Orleans, New York, Philadelphia, Pittsburgh, San Francisco, St. Louis and Seattle.

Leakproof Damper Regulator

What it describes as a completely rattle-proof and 100% leakproof damper regulator is offered by Elgen Mfg. Corp., Long Island City, N.Y. It has been designed for quality ductwork and high velocity systems, the company states.

Called Quadra-Matic, damper regulator boasts a polyethylene sealer component that is placed into the quadrant handle. When the handle is fitted on the



square end bearing of the damper blade and set flush against the side of the duct, a 100% airtight contact is said to be assured. Once quadrant and handle are in final position, all rattles are permanently done away with.

A common problem in the installation of damper controls has been the bellying of the duct after a period of time, with the result that end bearings on the damper blade would fall into the duct, the company explains. Such mishaps are difficult to correct since many of the ducts are located in inaccessible areas. The problem is eliminated in the case of installation of the company's damper regulator because a pre-assembled swivel and bearing is provided which is attached to the inside of the duct after being secured to the other end of the damper blade. Unit turns freely on a brass bearing in an enclosed housing, permanently.

More Information? Circle Item 63 on Inquiry Card.

Fuel Oil Controller

The fuel oil controller, a simplified oil control assembly that eliminates up to 40 fittings and pipe elbows, has been developed by Cleaver-Brooks Co., Milwaukee, Wis., for its lines of packaged boilers.

The valve assembly combines in one casting all the piping, gages, regulators, and valves that have been used in the integral fuel oil control system on Cleaver-Brooks boilers. It is the only packaged assembly of its kind in the industry, the company reports.

Basically, there are two different versions of the fuel oil controller—one for heavy oil, the other for light oil. The savings in fittings is particularly noticeable on the heavy oil control assembly because of the additional valves and gages required with heavy oil.

More Information? Circle Item 64 on Inquiry Card.

Hot Water Converters

Niagara Weldments Inc. (formerly Niagara Welding & Boiler Works, Inc., Niagara Falls, N. Y.) is in production on a line of fully standardized hot water converters comprising 114 models in 2- and 4-pass arrangements. Introduction of the line follows closely a new storage water heater line recently announced. Both lines bear the NiaWel tradename.

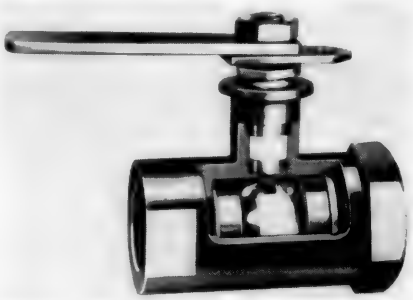
Designed for space heating service, and fabricated in strict accordance with ASME requirements, models are available for steam inlet pressures of 0, 2, 5, 10, or 15 psi and temperature ranges of 160-180 deg F, 180-200 deg, 190-210 deg, or 200-220 deg. Standard shells, flanges, nozzles, drains, tube supports, and cradles are of welded, flange quality steel construction. U-tubes of the removable bundles are of seamless drawn Admiralty metal or copper.

For special applications or conditions, shells, tubes, and other components can be fabricated from a variety of metals or alloys best suited to operating conditions. Units of special size or requiring special engineering are also available. All converters are hydrostatically tested to 150% of the designed working pressure prior to shipping.

More Information? Circle Item 65 on Inquiry Card.

Self-Adjusting Ball Valves

A line of ball valves in combinations of metals, seats and seals to handle practically any fluid, is announced by Homestead Valve Mfg. Co., Coraopolis, Pa. Featuring adjustable stem seal, a self-adjusting ball which seals with flow in either direction, and



stem shoulder to prevent ball from being forced downward, the line includes valves with Navy G bronze or semi-steel cast bodies; or brass, steel, and 303 or 316 stainless steel bar stock bodies.

Both cast and bar stock types have full-round pipe-sized passage for fluids, or restricted passage as desired. Offered now with flexible self-forming Teflon seats and seals, they will soon be offered in other materials such as: rubber, polyethylene, or Kel "F."

Valve sizes range from ¼ to 2½ inches for pressures up to 400 lb water-oil-gas, and temperatures to 450 deg F.

More Information? Circle Item 66 on Inquiry Card.

which man specified Typhoon ?

That complacent looking fellow on top of the pole. He knows Typhoon will deliver beyond specifications—guaranteeing satisfaction. With the addition of 28 new units to its 1961 Line, Typhoon offers the industry's broadest, biggest, most versatile group of packaged air conditioners, furnaces and heat pumps. Typhoon economy begins with its mass produced components, which can be custom-assembled to your order to meet any unusual requirement...**at little or no extra cost.** Typhoon quality begins with Power Reserve—superior components and oversize parts to deliver beyond rated capacities. Each Typhoon unit is built to take extreme weather conditions and sudden severe temperature changes without strain or breakdown. The 28 new units include nine heat pumps, three air handlers, three air cooled remote condensing units, three air cooled condensers, and ten self-contained package units. **For complete satisfaction,** specify Typhoon. It suits every need in air or water cooled units; ceiling, floor or roof mounted units; units that heat and cool or cool only — in capacities from 3 to 75 tons. Write us for complete product literature.

Water Cooled Self-Contained Packaged Units 3 to 75 Tons

TYPHOON

HUPP

TYPHOON AIR CONDITIONING DIVISION, HUPP CORPORATION
505 Carroll Street, Brooklyn 15, New York 2-4-1

☐ Please send me full product literature on Typhoon's 1961 Line.
☐ Please have a representative call for an appointment.

NAME_____

FIRM_____

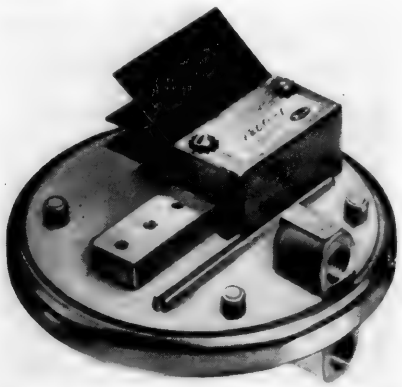
ADDRESS_____

CITY_____ ZONE____ STATE____

For more data circle this page number on card at back of book

Differential Pressure Switch

A differential pressure switch, No. 1800 Series, is available from F. W. Dwyer Mfg. Co., Michigan City, Ind. Switch is a low cost, compact unit (only 4 inches in diameter) of excellent sensitivity, operating from differential pressures as low as 0.15 inches water with ranges up to 80 inches. It will hold a set point through various total pressures and can be operated from plus, minus or differential pressures in any position.



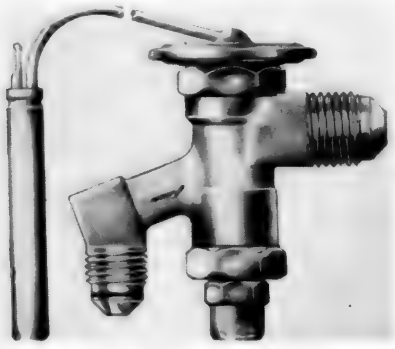
Unit can be applied almost universally for accurate, low pressure sensing and control such as in cooling coil defrost control, dust collection systems, air filters, air curtain systems, etc. With very few moving parts, it is virtually unaffected by severe vibration conditions, even near the actuation point.

Various arrangements of this pressure switch are available, from a basic unit incorporating only operating arm protection to switches with weather boot of neoprene, regular conduit enclosure or explosion-proof housing. Pilot lights, showing energized circuits, plus other features can easily be incorporated to meet specific needs.

More Information? Circle Item 67 on Inquiry Card.

High-Performance Expansion Valve

Greater capacity in a smaller size than previously possible, and substantial savings in serviceability



describe a high-performance expansion valve announced by American-Standard Controls Division, Detroit, Mich.

Developed specifically to meet most present-day industrial and commercial air conditioning and refrigeration requirements, the new valve is designed for use in both original equipment and general replacement installations where space is at a premium. Identified as the Detroit 900 compact capacity expansion valve, it is available in both internally and externally equalized and pressure-limiting types.

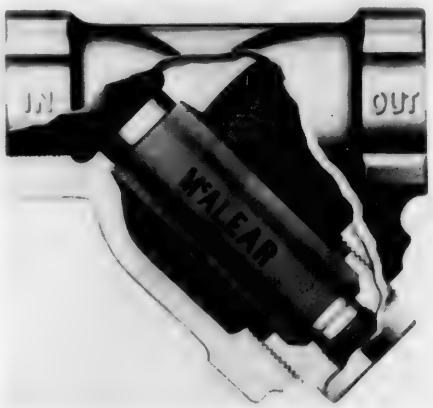
Used with R-12 or R-22 refrigerants and available with custom-charged power elements, this development reportedly provides the smallest-size adjustable valve per ton of refrigeration now commercially available. Capacity: R-12—.5 to 3 tons; R-22—.8 to 5 tons.

The manufacturer also announces the adoption of a simplified, five-digit numbering system for the valve. Designating pertinent specifications within the unit number, the new system provides quick, easy product identification and reference for the convenience of the user.

More Information? Circle Item 68 on Inquiry Card.

Y and Angle Strainers

A revised and expanded line of Y strainers and a block steel angle strainer are introduced by McAlear Mfg. Co., Chicago, Ill. The strainers are heavier in design than comparable previous models, yet are available at lower cost, the company states.



Nos. 530 and 530-GY strainers are said to be suitable for all steam, water, air, oil, or gas applications. They are designed to protect traps, regulators, meters and other equipment from dirt, scale, pipe cuttings and other foreign material. The following sizes and materials are available: ¼ to 3-inches in semi-steel; ⅜ to 2-inches in ductile iron or cast steel; 1½ to 2-inches in bronze or stainless steel. Stainless screens are standard for all strainers, with choice of four perforation sizes available at no extra cost.

More Information? Circle Item 69 on Inquiry Card.

YOU GET ALL 3

WITH THE BRYANT 337

1. EXCLUSIVE TRI-ALLOY HEAT EXCHANGER. Extra long life... exceptional resistance to high temperatures, corrosion, condensation... quick heat transfer.

2. LOW VOLTAGE CONTROLS Cost less to install than line voltage type . . . sensitive response gives better temperature control.

3. AUTOMATIC FAN SWITCH Delays starting fan until unit has warmed up—no cold blasts. Keeps fan running after gas shuts off until all usable heat is exhausted.

PLUS—**Bryant's unique** fan-motor assembly. Rotating end bell motor centers load between bearings reducing **bearing wear 75%.**

Extremely quiet operation.

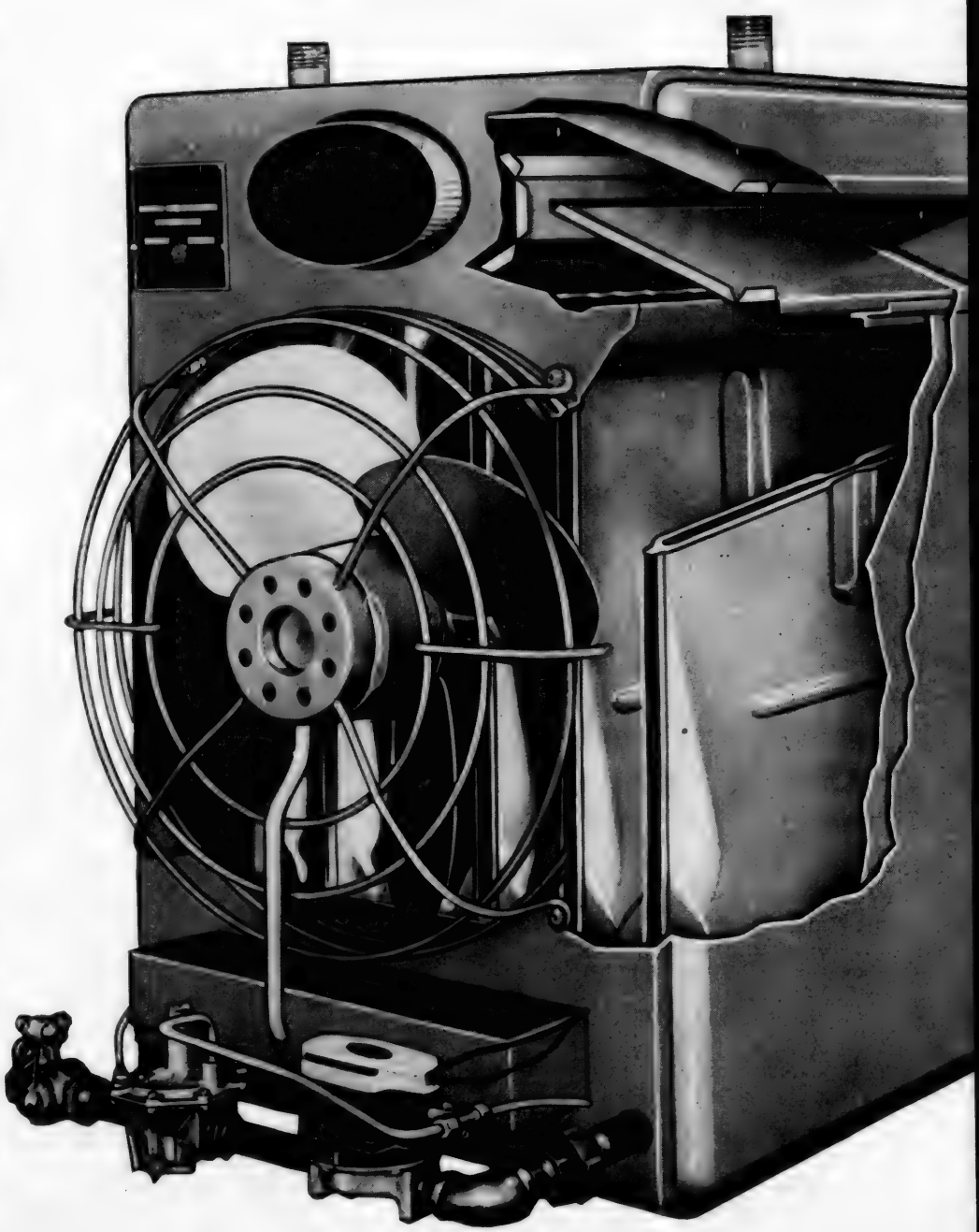
Exceptional service record—less than ½ of 1% returns.

A.G.A. approved for all gases; 10 sizes, 50,000 to 300,000 Btu.—Immediate delivery from full local stocks carried by Bryant factory branches and distributors.

BRYANT MANUFACTURING CO.
Indianapolis, Indiana

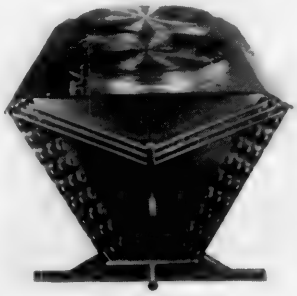
bryant

Unit Heaters



Air-Cooled Condenser

A new air-cooled condenser, designated the "V-Con", is announced by Halstead & Mitchell Co., Pittsburgh, Pa. The unit is a remote air-cooled condenser, with coils arranged in a V-shape so that air is drawn through them and discharged vertically upwards by the propeller fans. This arrangement, the company says, provides a low silhouette in a minimum of floor space.



Other features of the unit include direct drive fans, totally enclosed motors, and lightweight corrosion resistant aluminum cabinets.

The company is initially offering the V-Cons in capacities of three to 10 tons. These units round out the company's line of vertical and horizontal discharge air-cooled condensers in capacities of three to 150 tons. Also available is an air-cooled condenser with centrifugal fans.

More Information? Circle Item 70 on Inquiry Card.

Soft Cuff for Flexible Duct

A soft cuff which permits easy disconnecting of flexible duct from a fitting is announced by The Wiremold Co., Hartford, Conn. A special feature of the cuff is its ability to stretch. This not only assures a snug fit on nominal-sized fittings, but also permits connection of the cuff to end fittings that may be oversized.

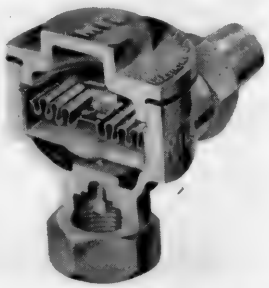
Wiremold flexible ducts, widely used for industrial ventilating and materials handling jobs, are normally furnished without cuffs. However, cuffs are recommended for installations where it may be necessary to disconnect the duct from the fitting, and where an airtight, dust-tight connection is required. They also eliminate metal-to-metal contact.

Furnished attached to duct, the cuff can be re-used if the duct should be damaged at any time. Or, if a permanent splice is required, the cuff can be permanently bonded to the duct. On special order, duct can be supplied with the cuff as an integral part.

More Information? Circle Item 71 on Inquiry Card.

Thermostatic Radiator Steam Trap

A low-priced steam trap, designed for applications on radiators, is announced by Mil Div., Farris Engineering Corp., Palisades Park, New Jersey.



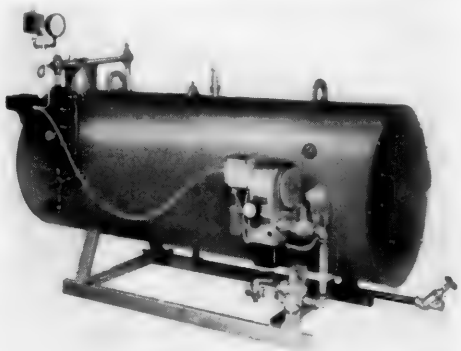
Type 25 trap maintains precise thermostatic regulation of steam flow and condensate removal with a stainless steel bi-metallic control element which responds instantly to temperature changes, the firm reports. Reliable performance is not affected by frost, water hammer or rough handling. This bi-metallic element cannot rupture or fail to operate.

Operation of the pressure balanced valve is controlled by the sensitive bi-metallic element and thus is unaffected by pressure changes. Trap is available in ½ and ¾-inch. Body patterns include angle and straightway, as well as the angle-union which complies with the standard radiator trap configuration.

More Information? Circle Item 72 on Inquiry Card.

Boilers Are Side Fired

A line of compact economy boilers featuring a new side-fired design, said to reduce floor space more than 20% over end-fired models of the same capacity, is announced by Eclipse Boiler Div., Eclipse Fuel Engineering Co., Chattanooga, Tenn. Mounting burner at the side reduces over-all length and makes new boilers more compact, the company reports.



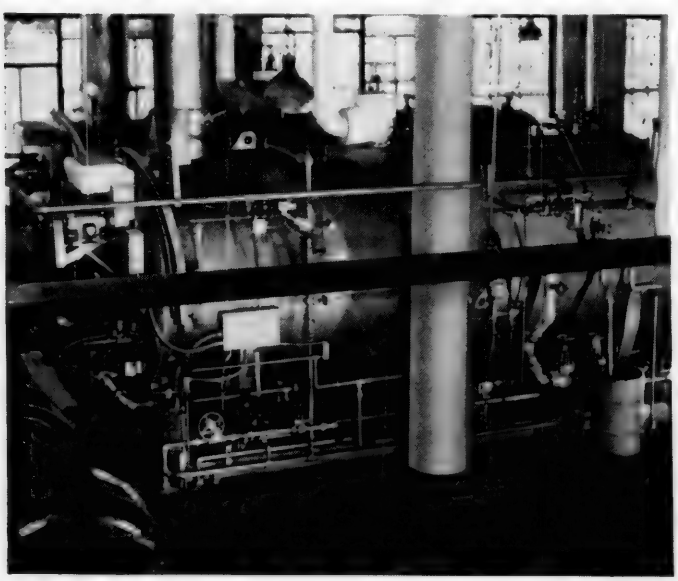
Boilers are available in gas, oil, or combination gas/oil-fired models, rated at 6, 12, 15, 20, and 30 hp, and operate from 201,000 to 1,005,000 Btu per hr output at 100 or 125-lb working pressure standard. Pressures are available to 500 lb w.p. Horizontal design puts all tubes below the water line to prevent corrosive action of oxygen and carbon dioxide.

More Information? Circle Item 73 on Inquiry Card.

can you afford to recommend a boiler designed 20 years ago?

BOILER ROOM CONVERTED TO WORK AREA

Robert A. Johnston Company, cookie, candy and chocolate products manufacturer in Milwaukee, Wisconsin, replaced four coal-fired boilers with two fully automatic, gas-fired CB boilers. Mr. James Vida, plant engineer, reports: "Compact Cleaver-Brooks design made it possible for us to install the boilers in another part of the plant — in an area of only 750 sq. ft. — releasing the old boiler room, 9000 sq. ft., for storage and work areas. It saved us the cost of an expansion project."



Today, with building costs twice what they were in 1945, your clients can't afford big boilers and the space to house them. They probably need greater boiler capacity, but they need extra space even more. The problem is to satisfy both needs.

To keep pace with climbing construction costs and the compact requirements of modern architecture, one manufacturer, Cleaver-Brooks, has proved that big boiler performance and capacity can be engineered into a small boiler package. Today's CB packaged boilers help solve many unusual installation problems. Low headroom is one example. Shortage of ground-level space is another; clean-cut, compact design cuts the space used, releases it for production or storage purposes. In some cases, "penthouse" installations have utilized space on an upper floor and *completely eliminated* the use of ground-level space.

Here are some of the features that combine for maximum space saving: four-pass design, forced-draft combustion, updraft construction and all the advantages of five square feet of heat-transfer surface per boiler horsepower. These standards of quality and compactness are only available from Cleaver-Brooks, manufacturers of the most compact, fuel-saving packaged unit on the market.

Cleaver-Brooks boilers are completely pre-engineered and tested as a package . . . expertly started by a trained field engineer. Sizes through 600 hp . . . oil, gas and combination oil-gas firing . . . larger sizes in Cleaver-Brooks Springfield water-tube boilers.

See your local Cleaver-Brooks agent or write for a set of boiler-room templates designed for consulting engineers.

Cleaver Brooks®

ORIGINATOR AND LARGEST PRODUCER OF PACKAGED BOILERS

CLEAVER-BROOKS COMPANY

Dept. D, 315 E. Keefe Ave., Milwaukee 12, Wisconsin

Volume Regulating Damper

A new type of volume regulating damper for adjusting combination residential heating and cooling systems is introduced by The Lau Blower Co., Dayton, Ohio, whose engineers say the device is a major step in simplifying the control of blower air delivery without changes in motor speed.

Called the Controllaire, the device is an integral

part of a blower assembly housing. In operation, it is opened or closed to adjust air volume. However, unlike conventional dampers, it is so designed to permit air redirected by the damper to flow out of the blower housing through rectangular openings. This is recirculated within the blower compartment.

With this method, the blower motor remains at a constant speed, no matter at what setting the damper is placed. This is particularly true with direct drive motors. The control works equally well on belt driven blowers, the firm reports.

More Information? Circle Item 74 on Inquiry Card.

Air Conditioning Products

Air Conditioning Div., Worthington Corp., Harrison, N.J., has announced some new products in its Full Choice Air Conditioning line. These include a twin-duct air blender; a packaged multizone unit; a unit for roof-mounted cooling or heating; and a new line of ventilating fans.

The twin-duct air blender has been designed for high velocity double-duct air conditioning systems and is adaptable for ceiling and under-window installation. The blenders operate without the use of motors, piston separators, or mechanical linkage.

The packaged multizone unit, called the "Multitemp" CMC series package, consists of three models having a cooling capacity range of 20 to 30 tons, with heating coils having adequate heating zone controls for heating, cooling, or a combination of both.

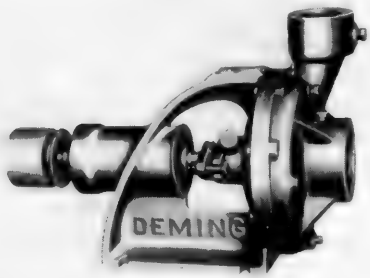
The basic WRA "Roofair" roof-mounted air conditioner is designed for cooling and dehumidification, and is available with gas, oil, or steam heat for year-round conditioning.

Line of ventilating fans is called the Series 600 Centriflow, and features an advanced wheel design with backwardly inclined blades which assures smooth and unrestricted air flow for high efficiency and quiet operation. According to the company, fans are especially desirable for operation where low noise level is a prerequisite.

More Information? Circle Item 75 on Inquiry Card.

End Suction Centrifugal Pump

A new end suction centrifugal pump is announced by The Deming Company, Salem, Ohio. Pump employs double ball bearings and is equally suited for belt or direct motor drive. Capacity range is from 10 gpm to 300 gpm, and heads range to 150 ft. Semi-open impeller is mounted on stainless shaft



with precision taper fit for perfect alignment and easy removal.

"Back-pull-out" feature enables pulling work parts without disconnecting casing from piping. Stuffing box and split gland are standard, but mechanical seal is available at no extra cost. Seal is recommended for temperatures up to 180 deg F when handling non-abrasive fluids.

More Information? Circle Item 76 on Inquiry Card.

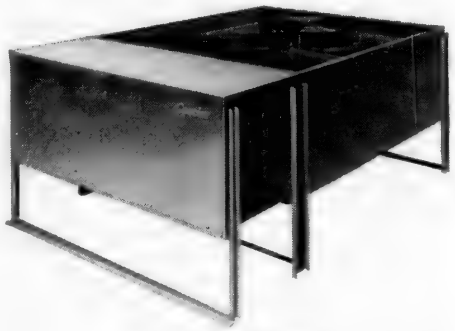
Metering System Components

Announced by Cleveland Controls, Inc., Cleveland, Ohio, is its new line of controllers, actuators, transmitters, indicators and manual stations, used in systems for accurate control of fuel and air in combustion processes.

These components are reported to offer many new and exclusive features that contribute to greater efficiency and economy in positioning and metering control.

The basic transmission system is electronic. Design of individual components is such as to integrate multiple functions where possible in single enclosures, thus achieving lower initial cost, simplified installation and less maintenance, because of fewer units per system.

More Information? Circle Item 77 on Inquiry Card.



OUTDOOR UNIT

INDOOR UNIT

PRACTICAL EVEN IN COLDER CLIMATES!

Carrier 10 and 15 ton Heat Pump Weathermakers

These new Carrier two-piece Heat Pump Weathermakers* offer many advantages for heating and cooling factories, department stores, theaters, banks and restaurants. Their improved design, combined with the heat load from concentrations of light, people or machinery, makes it possible to operate them as economically in colder climates as many types of conventional systems.

An all-electric, air-cooled system, the Carrier Heat Pump Weathermaker requires no combustion fuel in winter and no water in summer. And because a single system handles both cooling and heating, there is an overall first-cost savings for many new buildings . . . as well as complete elimination of the normal expense resulting from seasonal start-ups and shutdowns. There is also space saving through the elimination of a boiler, smokestack, water tower and fuel storage facilities.

To meet installation requirements, this two-piece Weathermaker offers a wide variety of arrangements. The indoor section may be suspended horizontally or vertically. Vertically, it may be hung from a wall or it may stand on the floor. Air distribution may be through ductwork or accessory plenum. The outdoor section, with its extremely low silhouette, makes it ideally suited for rooftop installation.

Your Carrier dealer, listed in the Yellow Pages, will be glad to give you complete information about these efficient, economical new 10 and 15 ton Heat Pump Weathermakers. Or write Carrier Air Conditioning Company, Syracuse 1, New York.

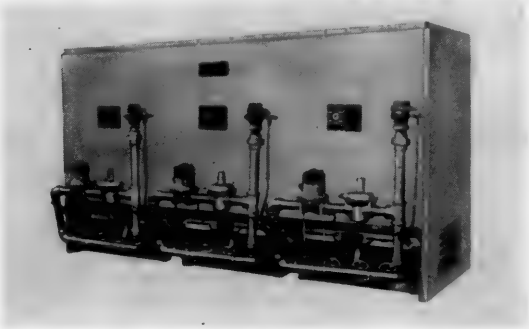
*Reg. U. S. Pat. Off.

Carrier Air Conditioning Company

Heavy-Duty Hydronic Heating

Hydrotherm, Inc., Northvale, N.J., announces its Multi-Temp heavy duty heating plants featuring electronic step-controlled input modulation. Especially designed for apartment house and heavy duty industrial applications, the units make it possible to match heat-input to heat-loss under all weather conditions.

The heating plant is composed of individual cast-iron heat exchangers with special horizonal sections



manifolded into common supply and return headers. Separate combustion chambers are sequence-fired by an electronic indoor-outdoor step-control which coordinates signals from an electronic outdoor thermostat and an electronic immersion thermostat in the supply water. Each combustion chamber will cut in or out in response to a signal from the electronic step-control. Thus, supply water temperature is automatically controlled according to the outdoor temperature. Wasteful short-cycling of the complete heating plant is prevented, and the need for three-way mixing valves is eliminated.

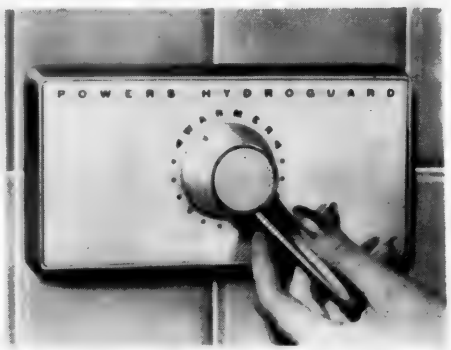
Multi-Temp system offers a range of input ratings from 360,000 to 3,600,000 Btu per hr, and will effect fuel savings of 20% on space heating applications, the company reports.

More Information? Circle Item 78 on Inquiry Card.

Thermostatic Shower Tub Control

A new model of its Hydroguard thermostatic shower tub control is introduced by The Powers Regulator Co., Skokie, Ill. It is restyled in a satin chrome case with an easy-grip pointer handle. Internal design retains all the safety features for which the Hydroguard is known. Among these are prevention of scalding water even if the handle is turned to maximum hot position, prevention of sudden bursts of hot or cold water regardless of the use of other plumbing fixtures, and simplicity of single-handle operation.

Heart of the unit is a sealed thermal element with only one moving part which prevents delivery of water above 110° F. Failure of cold or hot water supply automatically and immediately shuts off delivery. This complies with Federal Specifications WW-P-54 lb.



Unit can be installed with either concealed or exposed piping. When piping is concealed, the single handle feature simplifies installation by minimizing tile cutting. Another savings is provided by the built-in shut-off valve which eliminates the need for an external cut-off valve.

More Information? Circle Item 79 on Inquiry Card.

Centrifugal Roof Ventilators

A line of high efficiency, direct-drive centrifugal roof ventilators that are reported to exhaust more air volume per minute per horsepower is available from American-Standard Industrial Division, Detroit, Mich. Designated the Model CRD line, units are made in eight wheel sizes with capacities from 194 to 2788 cfm at free delivery. Ventilators are described as ideal for ventilating public buildings, schools, shopping centers, office buildings, churches,

auditoriums and theaters; and for exhausting gases and fumes from factories, laboratories, foundries and other industrial buildings.

Standard models are equipped with open motors with ball bearings and are mounted in rubber for quiet operation. Each ventilator carries a sound rating indicative of relative operating quietness level.

More Information? Circle Item 80 on Inquiry Card.

"Furnish and install prefabricated sound attenuating curb providing 90% reduction in sound power equal to the QT Sound Control Curb..."
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QT
SOUND CONTROL CURB
Patent Pending
HAS NO EQUAL!

Only Jenn-Air's QT Sound Control Curb absorbs 90% of the exhauster's sound power at inlet—a performance rating verified by independent laboratory tests. This is equivalent to the attenuation of 18 feet of 14" square duct lined with one inch of glass fiber (6# density).

Jenn-Air's QT Curb achieves whisper-quiet ventilation without sacrificing air moving capacity. Air delivery is only 10% less (including damper loss) than through a conventional curb.

Get *all the facts* before you specify —you'll find that the QT Sound Control Curb *has no equal* when it comes to effective noise suppression of power roof exhausters. Write for Bulletin 601-SC.

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JENN-AIR

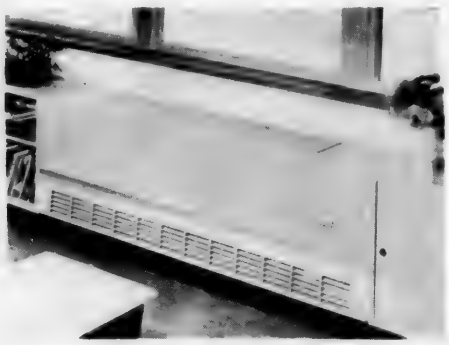
JENN-AIR PRODUCTS COMPANY, INC., 1102 STADIUM DRIVE, INDIANAPOLIS 7, INDIANA

For more data circle this page number on card at back of book

Electric Unit Ventilator

Edwin L. Wiegand Co., Pittsburgh, Pa., introduces a series of unit ventilators (Model NU) designed to provide all-electric comfort in new schools and school remodeling projects.

In classrooms, the units are installed along window walls, either individually or in conjunction with draft



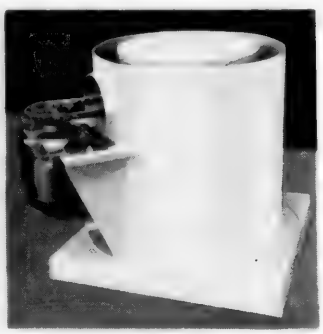
barrier storage cabinets. Units are offered in air capacities ranging from 600 to 1500 cfm. Each contains Chromalox fintube heating elements having large heat transfer surface and built-in overheat protection. Fans are direct connected to individual uni-bearing, lifetime lubricated motors, thus eliminating routine motor maintenance and repair. Motors may be operated at three different speeds and are equipped with built-in thermal overload protection.

Throwaway, renewable or permanent media, one-piece filters are available. A single control damper assures positive flow of outdoor air for ventilation and cooling. An optional built-in electric demand limiter allows maximum operating economy without sacrificing comfort in mild weather. Models are available in varying lengths, according to cfm and kw heating capacity, but all are only 13¼ inches deep by 26 inches high.

More Information? Circle Item 81 on Inquiry Card.

Plastic Roof Ventilators

Fabricated of the company's Rigidon thermosetting plastic, new roof ventilators combine corrosion resistance and efficient fan design, assuring long, corrosion-free service exhausting corrosive fumes.



According to Heil Process Equipment Corp., Cleveland, Ohio, all parts of the ventilator in contact with the fumes, including the impeller, housing, weatherhood, inlet and other parts, are of solid plastic. No metal is exposed to the fumes; there is nothing to rust.

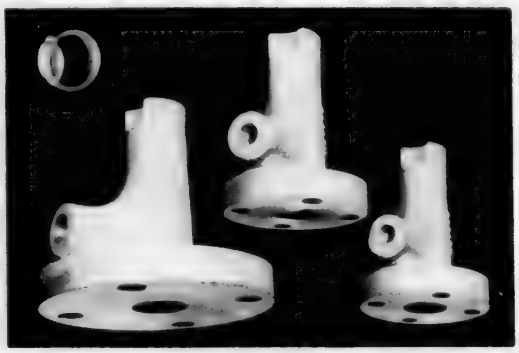
Unit has up-blast discharge that blows the fumes high into the air, minimizing corrosion to nearby rooms, parking lots, and other ground areas. The impeller is driven with either a direct drive, or V-belt drive with easily adjustable screw take-up for the belt. In both designs, the motor is protected from exposure to the fumes and is readily available for lubrication and periodic inspection.

More Information? Circle Item 82 on Inquiry Card.

Steam Traced Pipe Flanges

Three types of weld neck Traceline flanges are now available in sizes 1, 1½, 2, 3, 4 and 6 inches for installation of integral aluminum steam traced pipe, according to manufacturer, Alcast Fittings, Claymont, Del.

Flange pictured at right in photo has standard A.S.A. 150-psi drilling. At left is an adapter flange



with diameter and bolt circle one size larger than standard for the pipe size to fit steam traced valves.

The jump-trace flange shown in the center has a straight-through product line for flanging sections of pipe together; a jumper is used for steam passage around the flanges. An overlapping sole plate closes the trace section.

More Information? Circle Item 83 on Inquiry Card.

Hard-to-Get Fittings

Cajon Machine Co., Cleveland, Ohio, announces the availability of socket weld tube fittings in aluminum, brass, inconel, nickel, stainless steel and steel. In addition to a standard line in sizes from ⅛ through 1 inch OD tube, fittings are also produced in custom shapes, sizes and materials usually difficult to obtain, designed for applications involving problems of corrosion, pressure, and temperature. They will provide leak-proof performance under stress of vibration and shock, the company states.

More Information? Circle Item 84 on Inquiry Card.

(Continued on page 130)

for

heating and air conditioning

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AUTOMATIC CONTROLS DIVISION
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SILENTLY CLOSES NO HAMMER . . . NO VIBRATION	**RELIABILITY** CORROSION-PROOF BRONZE AND TEFLON
SILENTLY CYCLES NO SERVICING . . . NO ADJUSTING	**RELIABILITY** TEMPERATURE-PROOF TEFLON PARTS

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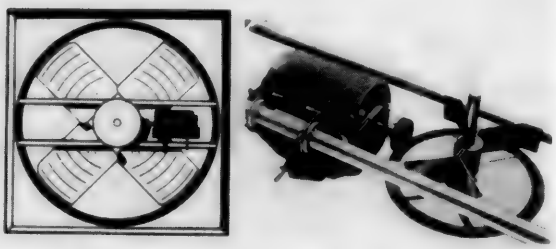
Exhaust Fans Have Friction Drive

The Roto-Drive line of attic and exhaust fans features a newly developed drive which completely eliminates the drive belt and pulleys and locates the motor directly in the cooling air-stream. According to Consolidated General Products, Inc., Houston, Tex., the units cost less to install, less to maintain and less to run. Fans also feature a specially designed fan blade which produces up to 18% more air-flow at no greater operating cost.



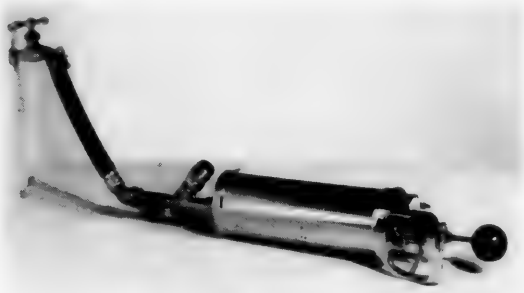
The driving system consists of an all-angle electric motor with automatic thermal overload which, by means of a friction drive wheel, powers a steel hub. Since the motor is located right in the air-stream it runs cooler for greater safety and better cooling efficiency, the firm reports.

Drawing at left in photo shows exact location of motor in relation to fan blades. Close-up detail of driving mechanism is shown at right.

More Information? Circle Item 85 on Inquiry Card.

Clears Hot Water Lines

A portable device, the Hydraulic Water Ram, which clears blocked drains or plumbing fixtures by hydrostatic impact through the release of a charge of compressed air, can now be used for removal of rust and corrosion from hot water lines. This use of the tool is made possible through an adaptor hose which is furnished as an accessory, according to the manufacturer, Hydraulic Manufacturing Co., Bridgeport, Conn.

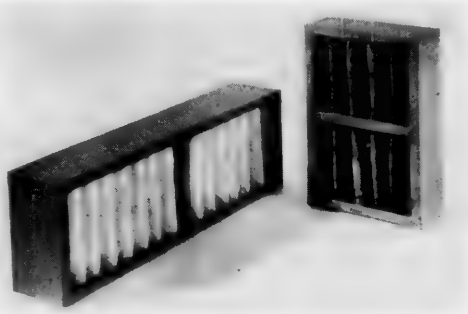


In clearing hot water lines, the adaptor hose is secured firmly over the hot water faucet. The ram, which is equipped with a self-contained hand compressor, is then loaded to about 150 lb. The faucet to which the adaptor hose is connected is then turned wide open, and the ram is discharged by snapping the trigger. The slug of compressed air drives back against the column of water in the faucet and hot water line. The ram is then disconnected from the faucet, and the rust and corrosion which has been dislodged is allowed to flow out.

More Information? Circle Item 86 on Inquiry Card.

Disposable Interception Filter

A disposable interception filter of pleated glass mat material provides maximum filter area for room recirculators, kitchen range hoods, electronic cabinet cooling, and similar applications. According to the manufacturer, Cambridge Filter Products Corp., Syracuse, N.Y., the low-cost filter provides NBS dust spot average efficiencies from 80 to 95%, depending on filter media used.



Since all air handled passes through the filter media, positive filtration is achieved. Efficency improves as the filter becomes loaded with dust. Dust cannot spill off the interception filter, and ion balance in the room is not affected since filtration is not dependent on positive ionization. The manufacturer reports maintenance-free service, with average filter life ranging from 1,200 to 10,000 hours, depending on dirt load and nature of supply air.

More Information? Circle Item 87 on Inquiry Card.

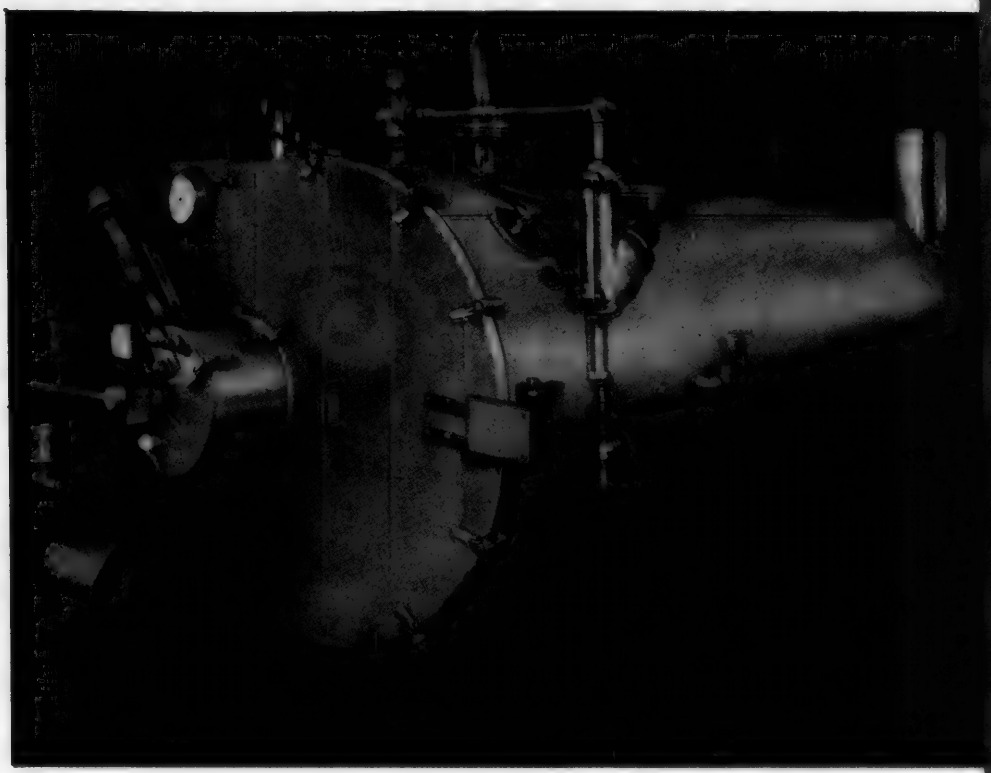
Plastic Drainage Fittings

Sonoco Products Co., Hartsville, S.C., announces the availability of plastic drainage fittings. These high quality fittings were designed for use with Duropipe, the company's bituminized fibre pipe.

The plastic fittings were selected after a careful study of their durability, unrestricted flow, acid resistance and quality. After testing, they were found to compare to the high standards of Duropipe, the firm reports.

Fittings are available in four-inch adapters, Y's, T's, ⅛ and ¼ bends.

More Information? Circle Item 88 on Inquiry Card.



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...the greatest advance in packaged firetube boiler design in seven decades!

Here for the first time, is a packaged boiler that gives you an ease of operation, dependability and accessibility often hoped for but never before achieved!

The result of more than two years of development and testing, the *Powermaster Positive Flow* boiler has been tried, tested and proved by one of America's foremost consulting engineer firms. Among its many tried and proven features are: accelerated internal circulation which greatly improves heat absorption efficiency . . . *PyroFlow*® burner system which can be easily converted in the field from/to either oil or gas without burner modification . . . hinged front and rear covers . . . optional dryback or wetback construction . . . quieter operation.

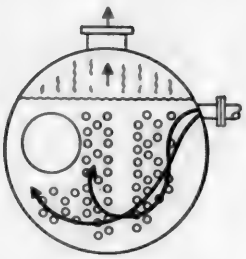
No other boiler can match the performance of the Powermaster Model PF for generating steam or hot water economically and dependably. A comparison of performance tests with other boilers will prove this is no idle statement.

For complete details of the *Powermaster Positive Flow* boiler, write for Bulletin No. 1275. If you are interested in leasing the boiler, a leasing arrangement may be made with your local O&S distributor.

ORR & SEMBOWER, INC.
BUILDERS OF BETTER BOILERS SINCE 1885

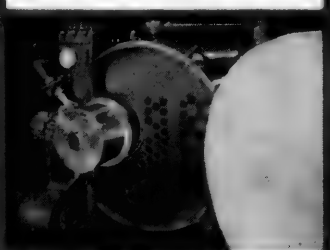
ORR & SEMBOWER, INC.
980 Morgantown Road
Reading, Pa. • Since 1885

Powermaster® **POSITIVE FLOW®**
PACKAGED AUTOMATIC BOILERS

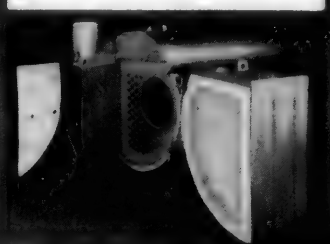


POSITIVE CIRCULATION
Design permits boiler feed injection and natural thermal circulation to augment each other. This provides the maximum water circulating rate and the most efficient form of heat transfer, **counterflow.**

SIDE LOCATED FURNACE
Side located furnace eliminates danger of heat damage due to stagnant water and sludge. Turn-around spaces are simple, accessible and positive sealed.



HINGED FRONT COVER
Hinged front cover, with quick-opening fasteners (no bolts) can be opened for access to heating surface without disturbing burner, wiring or piping.

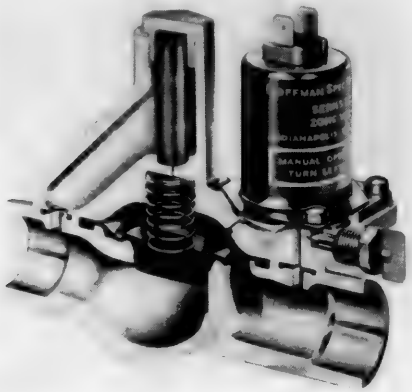


DIVIDED REAR COVER
Hinged rear cover, also with quick-opening fasteners, permits ease of accessibility and maintenance. Each cover section forms a separate seal in a single plane, providing protection from short-circuiting of combustion gases. No internal baffles to leak.

Quiet, Compact Zoning Valve

With zoning valves, manufactured by Hoffman Specialty Mfg. Corp., Indianapolis, Ind., each living or working zone can have individual temperature control —whether in a small, 2-zone residence or a large multi-zoned hotel or office building.

Designed for use on 2-pipe hydronic heating and cooling systems, this valve accurately maintains pre-



determined zone temperature, according to the needs of the zone's occupants, exposure to outdoor temperatures, and design or location of building.

Called quiet in operation and compact in size, valve is a diaphragm-type, operated by an electromagnetic coil and pilot valve. With large passageways to prevent clogging, valve can be installed in any position—on feed lines of heating or cooling units, or on return header at the boiler. Arrow cast in brass valve body shows direction of flow.

More Information? Circle Item 89 on Inquiry Card.

Two Surgeon's Lavatories

Two new surgeon's lavatories—one a flat slab model and the other with a 4-inch back — are announced by American-Standard Plumbing & Heating Division, New York, N. Y. Made of one-piece vitreous china, the lavatories are offered with a large variety of trim arrangements and supporting methods, concurring with modern hospital usage.

Overall size of the lavatories is 28 x 20 inches, with a bowl size of 12 x 14 inches. To provide the maximum area on each side of the lavatory bowl for instrument trays, the deck area slopes toward the bowl from the top edge of the outside rim. Besides permitting larger trays, this generous deck area makes the lavatory convenient for use in many other hospital locations.

Besides being adaptable to all brackets and hangers currently used, the new units are reported to be the only surgeon's lavatories that can be supported with a concealed arm chair carrier. The model with the back is also available with a china pedestal, as illustrated.

More Information? Circle Item 90 on Inquiry Card.

Versatile Ball Valve

What is reported to be an entirely new concept in ball valve design, featuring major improvements in sealing characteristics, compact one-piece forging, and built-in union ends which simplify installation, operation and maintenance, is announced by Clayton Mark & Company, Evanston, Ill.

Engineered for rapid installation and fast disassembly for maintenance, the Petro ball valve is designed to control flow of liquid or gas in petroleum, chemical, food processing and a wide range of industrial piping systems.

More Information? Circle Item 91 on Inquiry Card.

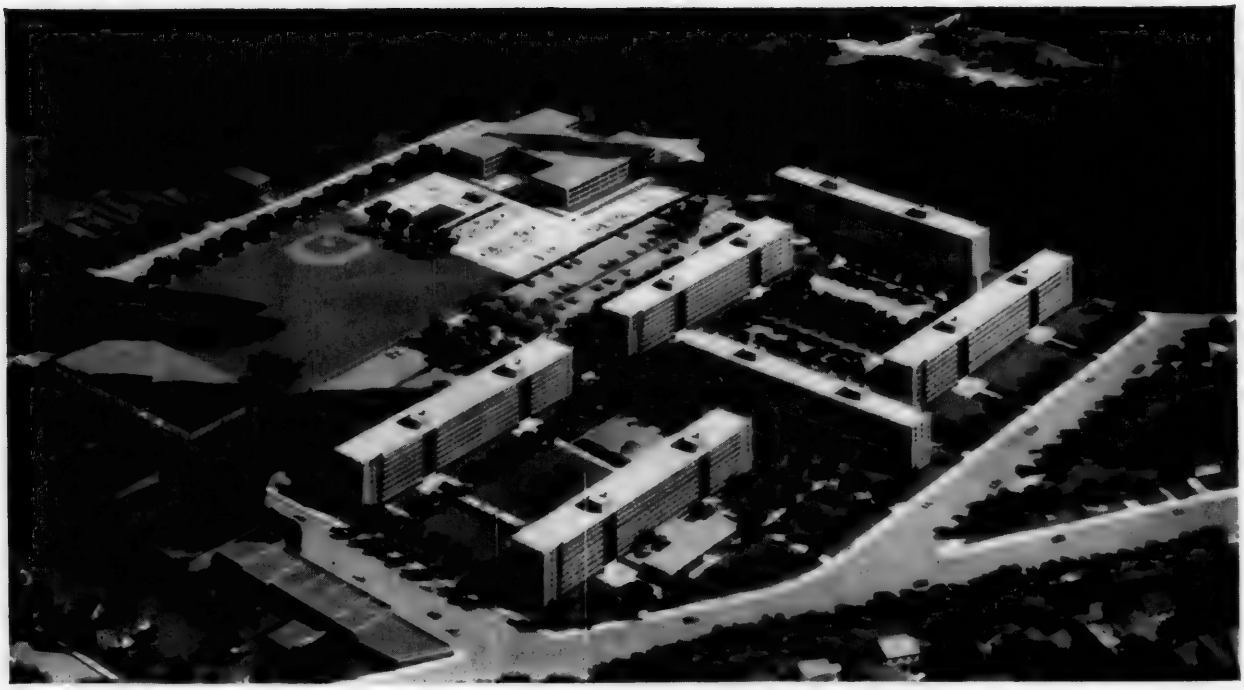
Expansion Compensators

According to Flexonics Corp., Maywood, Ill., its original Model H expansion compensator, designed to absorb thermal expansion in pipes up to 3 inches, is now available as Model HS, manufactured entirely of corrosion-resistant stainless steel.

Screwed, welding, or flanged ends; heavy-duty 2-ply bellows; positive anti-torque mechanism; and protective shroud are all of stainless steel. This permits use of this low-cost device under corrosive conditions, at working pressures up to 175 psi, temperatures up to 750 deg F.

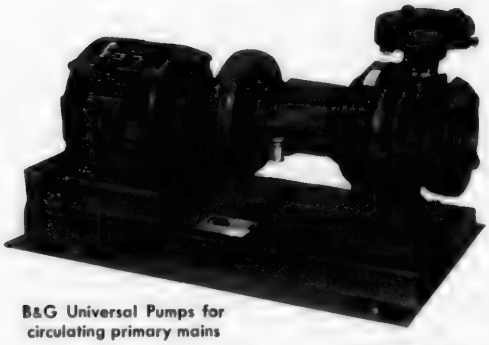
Also announced is an all-bronze expansion compensator, primarily for applications where the use of dissimilar metals might cause corrosion problems. Model HB is designed for working pressures to 150 psi, temperatures to 406 deg.

More Information? Circle Item 92 on Inquiry Card.

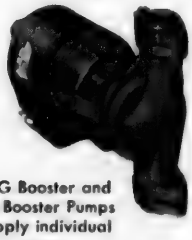


SPACE HEATING
...DOMESTIC WATER HEATING
...SNOW MELTING

ALL PROVIDED BY A B&G *Hydro-Flo* SYSTEM



B&G Universal Pumps for circulating primary mains



B&G Booster and PD Booster Pumps supply individual zones

B&G Monoflo Fitting

Stapleton Houses, Staten Island, N. Y.
Owner: The New York City Housing Authority
Architects: Ballard, Todd and Snibbe
Mechanical Engineers: Carlson & Sweatt
Mechanical Contractor: H. Sand & Co.

This example of contemporary mass housing employs *hydronic* heating at its versatile, economical best. Space heating, domestic water heating and snow melting are all effected by means of circulated hot water. *Primary and secondary pumping*, as conceived and developed by B&G engineers, makes possible this triple-function system.

Where multiple buildings or multiple zones are to be heated with circulated water, this pumping method materially reduces the pump horsepower required, improves heat control and saves fuel.

This installation is basically a two-zone primary distribution system with 3 secondary heating zones, 1 secondary domestic water zone and 1 secondary snow melting zone in each building. The space heating risers are of the B&G up-and-down Monoflo type, using 3,303 Monoflo Fittings.

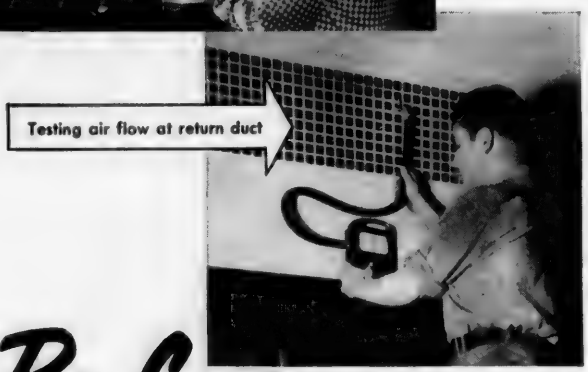
Write for free booklet which gives detailed information on this more efficient, more economical method of heating with water.

BELL & GOSSETT
COMPANY

Dept. GP-4, Morton Grove, Illinois

Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Drive, Toronto 16, Ontario

For more data circle this page number on card at back of book



Be Sure the first time
in balancing air flow systems

The Alnor Velometer®

gives a quick accurate check of air movement at outlets, returns, plenum chambers, static pressure in ducts, friction loss at ells and deflectors.

Readings are made directly in f.p.m. on the Velometer dial. So sensitive, readings as low as 20 f.p.m. can be made. The triple range scale registers up to 3000 f.p.m. and 6000 f.p.m.

Velometer Set No. 3G

Recommended for the air conditioning, heating and ventilating contractor. Consists of the Velometer with rugged carrying case, angle supply jet, suction (return) jet, static pressure jet, Price f.o.b. Chicago $194.

Velometer Jr.

For quick simple checking at outlets where attachments are not required. A compact instrument only 4" x 3" x 1½". Capacity ranges

0—200 f.p.m. to 800 f.p.m.
0—400 f.p.m. to 1600 f.p.m.
0—500 f.p.m. to 2500 f.p.m.

Price, with genuine leather carrying case, $44.00 f.o.b. Chicago. All models carried in stock for immediate delivery.

Alnor INSTRUMENTS

ALNOR INSTRUMENT CO.
Division of
Illinois Testing Laboratories, Inc.
Rm. 570, 420 N. LaSalle St., Chicago 10, Ill.

For more data circle this page number on card at back of book

Thermostatic Ventilator

A ventilator which opens and closes automatically with variations in temperature is the newest aluminum product for use in residential, commercial, or industrial buildings.

Equipped with movable louvers, controlled by a factory-set thermostat, the innovation is manufactured by Thermvent Corporation, Detroit, Mich., of high-strength metal supplied by Aluminum Company of America.

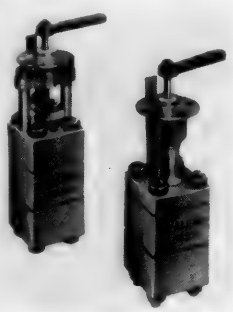
The young lady pictured is demonstrating how the louvers shut tight when the temperature drops to 50 deg F. They move gradually to a full-open position when the thermometer rises to 70 deg. Seven available models range from the foundation type, seen here, to gable, soffit, and roof louver designs. Each ventilator is complete in itself, operates independently, requires no electrical connections, and is easily installed because the units are produced in standard ventilator opening sizes.

Most models are available with mesh insect screen, and with a fusible link which melts in case of fire, automatically closing the louvers and stopping air circulation until the blaze is quelled.

More Information? Circle Item 93 on Inquiry Card.

Heavy-Duty Valves

Two block steel valves for continuous, heavy-duty flow regulation applications have been added to the line of industrial instruments and regulators produced by McAlear Manufacturing Co., Chicago, Ill.



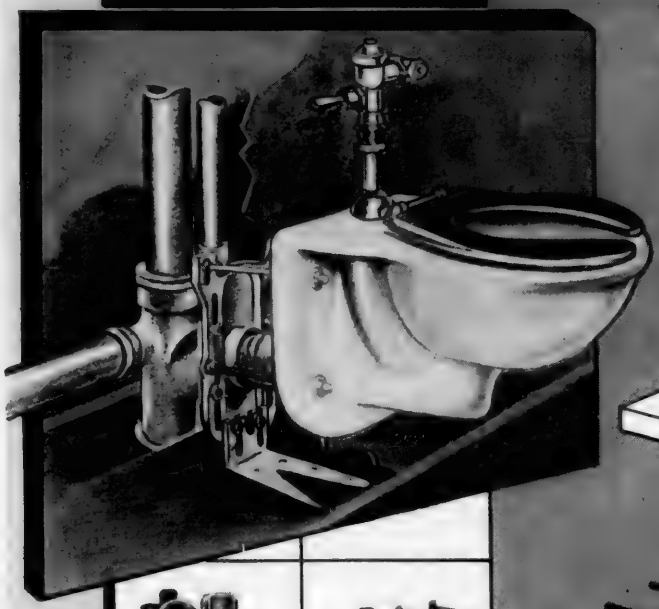
Specifically designed for rugged applications, these valves are used in continuous boiler (surface) blowdown systems, hydraulic service, instruments, throttling service, water column blowdown, soot blowers, boiler sampling service, and flow control of volatile liquids (anhydrous ammonia, chlorine).

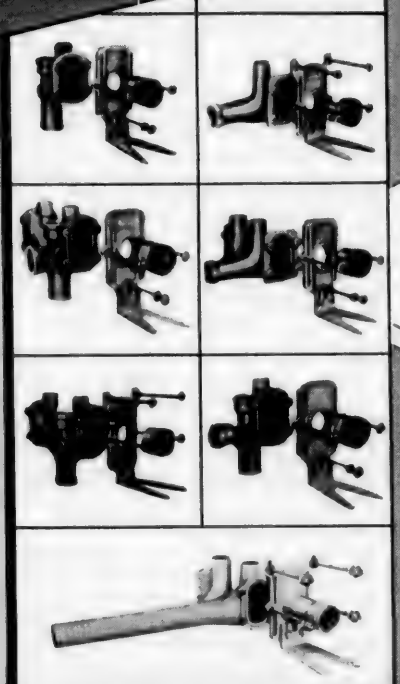
Featuring a heavy design and extra thickness at all wear points, valves are available in carbon steel or chrome-moly steel, and provide accurate flow regulation within 1% of desired flow.

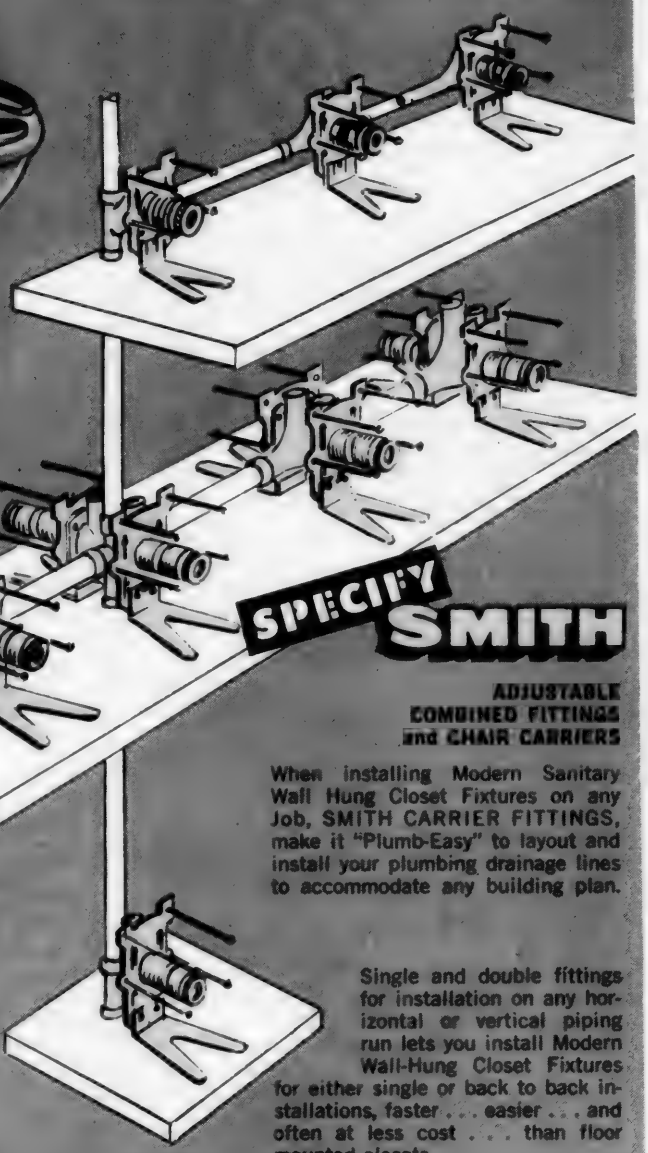
More Information? Circle Item 94 on Inquiry Card.

JAY R. SMITH
CARRIERS

MAKE IT EASY
TO *INSTALL*
ANY CLOSET
OFF THE WALL!







SPECIFY SMITH

ADJUSTABLE
COMBINED FITTINGS
and CHAIR CARRIERS

When installing Modern Sanitary Wall Hung Closet Fixtures on any Job, SMITH CARRIER FITTINGS, make it "Plumb-Easy" to layout and install your plumbing drainage lines to accommodate any building plan.

Single and double fittings for installation on any horizontal or vertical piping run lets you install Modern Wall-Hung Closet Fixtures for either single or back to back installations, faster . . . easier . . . and often at less cost . . . than floor mounted closets.

To support every make and model of Syphon Jet or Blow Out Wall Hung CLOSET FIXTURE . . . SMITH fully adjustable Closet Fitting Carriers are available in a complete line of sizes and variations to accommodate the requirements of every job.

CHAIR CARRIERS · DRAINS · INTERCEPTORS · HYDROTROLS

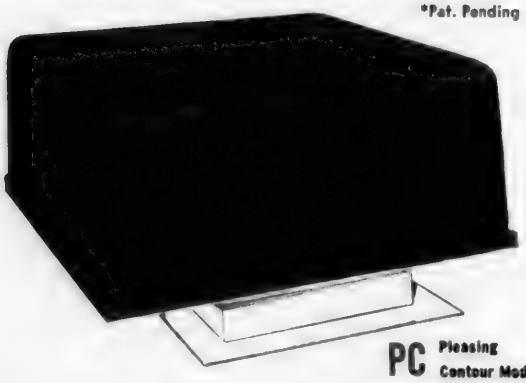
JAY R. SMITH MFG. CO.
Union, New Jersey
PLUMB-EASY

Introducing . . .

DAVIDSON

Roof Exhaust Fans with Fiberglass Housings* in COLOR!

*Pat. Pending



PC Pleasing Contour Model

Now . . . an extensive line of low-profile PC Fans is available with your choice of six sealed-in colored housings: light blue, dark blue, tangerine, buff, gray and white.

These new housings deaden sound, require no maintenance and withstand all elements. This new dimension in styling . . . plus all the advantages of Davidson Hyduty PC Fans:

- Famous Davidson rugged construction
- NEMA Standard Motors
- Vibration-isolated construction
- Ratings conform to Standard Test Code

For complete facts, write:

DAVIDSON FAN CO.

Dept. H, 213 California St.
Newton 58, Mass.

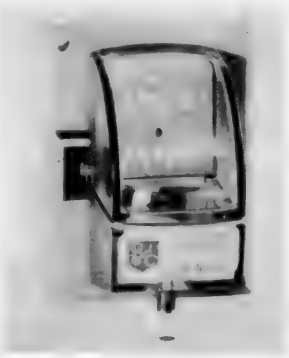
The original manufacturer of roof fans — Founded 1915

Charter Member AMCA

For more data circle item 158A

Indicating System

Announced by General Controls Co., Glendale, Calif., is its Blocked Filter indicator switch and remote indicator signal light, designed to light when a filter has become so clogged as to be ineffective.



The "L-18" switch can be used with a separate remote indicator signal light, or with the "T-190" room thermostat with a sub-base containing an indicator signal light. All lights operate on 24 volts.

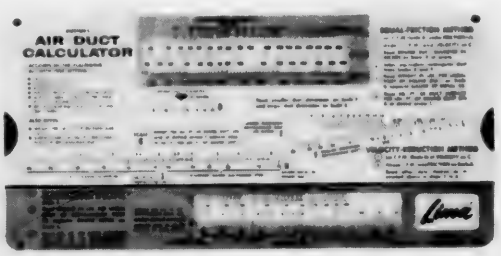
In operation, the remote indicator signal light is energized when the switch senses a restriction in the air flow across the filter, sufficiently great to indicate that the filter is clogged and should be cleaned or replaced. When a clean filter is installed, the control automatically resets itself, turning off the indicator signal light. Indicating system can be easily applied to all central heating, cooling, air conditioning and heat pump systems using filters.

More Information? Circle Item 95 on Inquiry Card.

Air Duct and Grille Calculator

Lima Register Co., Lima, Ohio, has introduced a sliderule-type calculator aimed at reducing calculations required in air duct and grille installations.

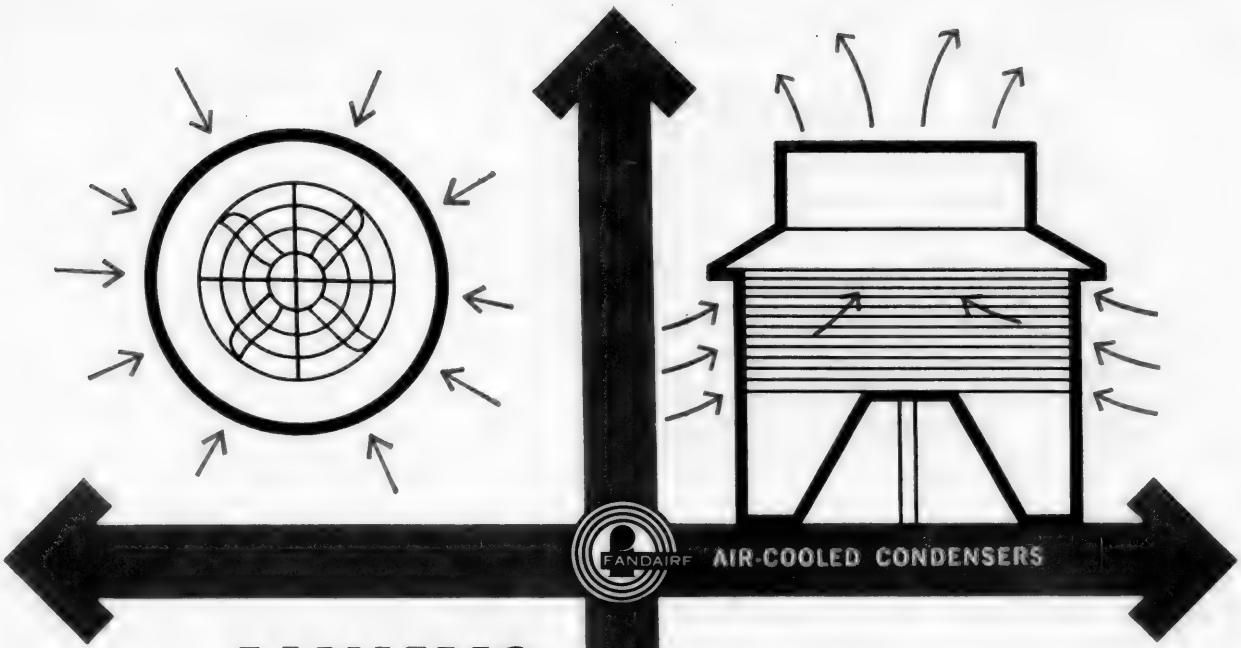
At one setting, the calculator gives accurate readings of friction, velocity in feet per minute, weight per lineal foot of round duct, and surface area in square feet per lineal foot of round duct.



The back of the calculator serves as a register and grille selector. The register selector shows free area recommended face velocity, cubic feet per minute, heating and cooling Btuh, as well as throw and spread.

The grille selector is just as simple. Setting the cfm to be handled in the window presents a choice of grilles that will handle the air efficiently.

Calculator is available at one-dollar each through Lima wholesalers, or it may be purchased directly from the company.



ALWAYS FACED RIGHT

SET FANDAIRE ANYWHERE

REGARDLESS OF WIND DIRECTION

Fandaire's original circular design has basic exclusive features that are making this air-cooled condenser the new standard of the industry. There are good reasons why: this modern low silhouette condenser is engineered around the high heat-dissipating Yuba fintube. Every spiral is surrounded by swiftly moving cool air from every direction. Although Fandaire's heavier fin construction assures higher heat transfer efficiency, the entire unit weighs at least one-third less than ordinary condensers.

Fandaire's circular design eliminates return bends and allows a true counterflow arrangement – coolest gases meeting the coolest air. Cool air is drawn in from all sides, not off the hot roof . . . hot air is expelled up and out. The entire unit can be positioned where needed, without guy wires or extra bracing. Piping and installation savings can be considerable.

Built for industrial, commercial and home installation – from 3 to 120 tons, single or multiple units. Get full details today.

YUBA

specialists in circular air-cooled condensers and condensing units

YUBA FANDAIRE DIVISION

Tulsa, Oklahoma

YUBA CONSOLIDATED INDUSTRIES, INC.

For more data circle this page number on card at back of book

TYPE GP
CLOSE-COUPLED
CENTRIFUGAL

CUT PUMP COSTS

USE AURORA CENTRI-PAC PUMPS

CAPACITIES TO 400 GPM / HEADS TO 150 FEET

NOW AVAILABLE IN 11 PACKAGED SIZES

AIR CONDITIONING EQUIPMENT / CIRCULATING SERVICES / GENERAL SERVICES

- LOWER IN COST . . . made possible by standardization of most popular sizes packaged and stocked for immediate off-the-shelf shipment.
- EXTREMELY COMPACT . . . close-coupled design saves valuable space and is more easily installed.
- HIGHLY EFFICIENT . . . low horsepower requirement means less initial cost and lower operating expense.
- EASILY MAINTAINED . . . pump can be completely disassembled for inspection and repair without disturbing the piping.
- QUALITY CONSTRUCTION . . . bronze fitted, mechanical seals, drip-proof NEMA rated motor with stainless steel shaft and built-in overload protection, and cast bronze impeller keyed and locked in position.
- SMOOTH, QUIET OPERATION . . . low NPSH meets critical suction conditions.

You may also select from a complete line of horizontal or vertical mounted pumps and flexible-coupled pedestal-mounted pumps engineered to your specific requirements.

WRITE FOR BULLETIN 117 PKG

AURORA Always PUMPS

AURORA PUMP DIVISION
THE NEW YORK AIR BRAKE COMPANY
690 LOUCKS • AURORA, ILLINOIS
LOCAL DISTRIBUTOR IS LISTED IN THE YELLOW PAGES OF YOUR PHONE BOOK

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NFPA STANDARDS

(Continued from page 12)

whether or not a member of the Association, may speak for or against the proposals before action is taken at the meeting. NFPA standards are widely made the basis for ordinances and regulations relating to fire safety, and also extensively used by commerce and industry as the basis for good practice.

Among the new and revised standards to be offered at the May meeting by NFPA technical committees are the following proposals:

Proposed is a revision in the present standard on residence type warm air heating and air conditioning systems, calling for an increase in clearance between furnaces and overhead combustible construction; important changes in spacing requirements in the standard on installation of sprinkler systems, predicated on last year's tests conducted by Factory Mutual Engineering Division.

The NFPA Committee on Carbon Dioxide Systems will submit a complete revision of the existing standard on this subject, based on newly-developed principles which significantly increase the efficiency of this protective equipment, and also allow more latitude in design. A completely revised version of the present table of common hazardous chemicals, re-titled as "Hazardous Chemicals Data," will incorporate latest information on fire and explosion hazards as well as recommended storage and fire fighting procedures.

Changes in two NFPA standards to permit the use of Type L venting system in fuel-burning appliances which have been tested and listed as suitable for such use are proposed.

ASTM COMMITTEE RECOMMENDS CHANGES IN #2 OIL SPECS

Technical Committee *E* of Committee D-2, of American Society for Testing Materials has voted unanimously to make certain

changes in gravity requirements of #2 heating oil. The changes, when formally adopted, will result in greater uniformity of product. The recommended changes are subject to confirmation by mail ballot by the overall committee (D-2) and ASTM, after which the new standards become official.

INSULATION THICKNESS TIED TO DOLLARS-AND-CENTS DATA

A new system for estimating thermal performance of buildings that utilizes data compiled from over twenty years of performance figures for thousands of industrial and commercial buildings and plants was introduced by Owens-Corning Fiberglas Corp., Toledo, Ohio.

The system, called Dividend Engineering by the company, is facilitated by evaluation-analysis charts which identify insulation thicknesses in terms of dollars-and-cents savings in initial equipment and building operating costs. The analysis takes into account such factors as cost of equipment and energy, including gas, coal, and electricity, shading devices, climatic conditions, construction costs, cost of money, depreciation, and insurance.

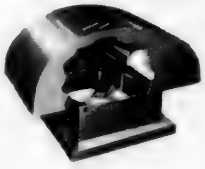
The company's entire sales force, equipped with the charts and trained in their use, is available to engineers and architects.

BRI ANNOUNCES TOPICS FOR SPRING CONFERENCES

Major technical programs on adhesives and sealants, plastics, public entrance doors and new building research will be featured at the 1961 Spring Conferences of the Building Research Institute, May 16-18, at the Shoreham Hotel, Washington, D. C.

George J. Schulte, Minnesota Mining & Manufacturing Co., is chairman of the BRI planning committee developing a comprehensive program in three parts on adhesives and sealants. Leslie M. Jackson, Head, Arch. Dept., The Tremco Mfg. Company, will be the session chairman on Requirements for Weatherproofing Thin Shell

about fans that move air in either direction with equal efficiency...
HARTZELL REVERSIBLE FANS



Intake one minute, exhaust the next, with the same fan. You can do it with the unique Hartzell reversible fan — making one unit do the work of two with air moving efficiency that is seldom achieved with a conventional one-way fan. Hartzell reversible fans are ideal for many special ventilating jobs and for a wide variety of cooling and drying applications. Sizes from 18″ to 42″, in ring or duct section mounting or in a special roof ventilator housing. Here's more proof that Hartzell has the equipment, and the engineering "know-how", to help you solve your unusual air moving problems.

For complete details, just give your nearby Hartzell field engineer a call. You'll find him listed in the Yellow Pages or in the Hartzell catalog in Sweet's Plant Engineering and Industrial Construction Files.

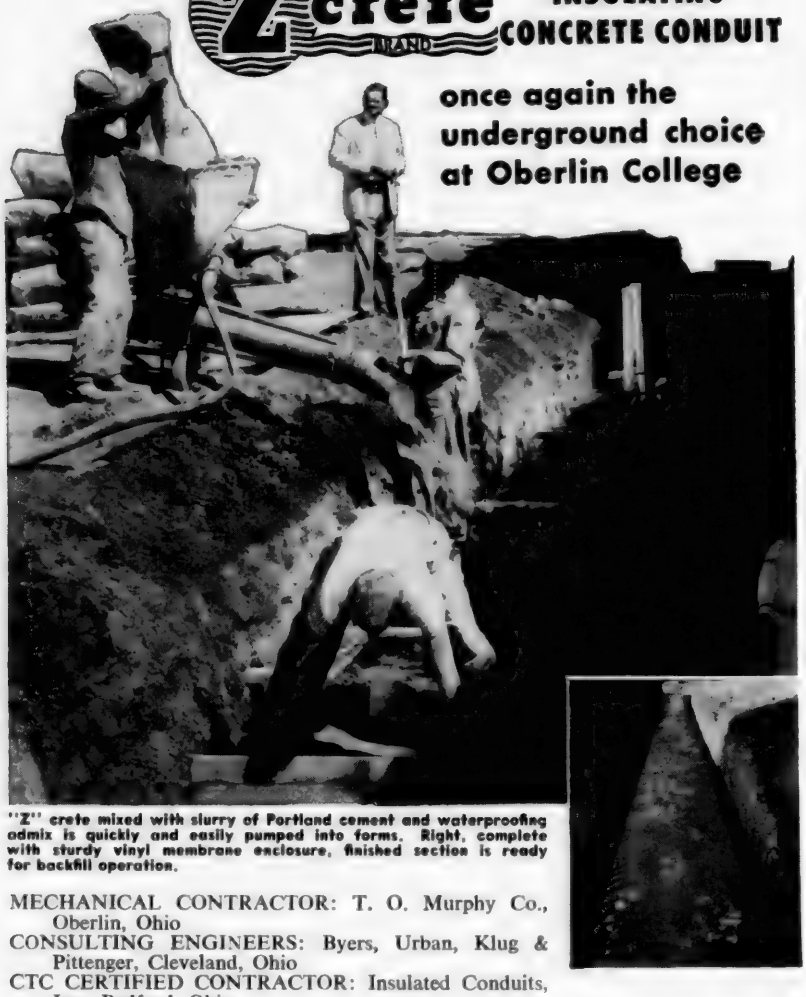
Hartzell PROPELLER FAN COMPANY
Division of Castle Hills Corp. • PIQUA, OHIO
(HARTZELL)
A Member of AMCA

For more data circle this page number on card at back of book

Now drainable, driable, better than ever

"Z"crete BRAND INSULATING CONCRETE CONDUIT

once again the underground choice at Oberlin College

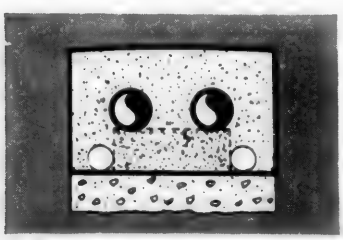


"Z" crete mixed with slurry of Portland cement and waterproofing admix is quickly and easily pumped into forms. Right, complete with sturdy vinyl membrane enclosure, finished section is ready for backfill operation.

MECHANICAL CONTRACTOR: T. O. Murphy Co., Oberlin, Ohio
CONSULTING ENGINEERS: Byers, Urban, Klug & Pittenger, Cleveland, Ohio
CTC CERTIFIED CONTRACTOR: Insulated Conduits, Inc., Bedford, Ohio

Distinguished as the birthplace of co-education on the college level in 1835, Oberlin College, Oberlin, Ohio, has traditionally emphasized permanence and performance reliability in the expansion of its physical facilities. Recently, in adding 1,116 feet of large-size high temperature steam line to its underground system, "Z" crete Insulating Concrete Conduit, as in the past, was the pipe insulation specified by the consulting engineers for the particular soil, water and site conditions involved. Custom field fabrication was handled by the local CTC certified contractor, Insulated Conduits, Inc., who provide local responsibility and pride in a job well done.

Following the example of the consultants for Oberlin College, other forward looking planners are recognizing "Z" crete systems as the preferred solution for rehabilitation of existing underground lines as well as for long, trouble-free life and dependability in new construction.



Only "Z" crete brand systems offer:

- Flexibility of field fabrication
- Tough, temperature stable, watertight membrane enclosures
- Insulating concrete highly resistant to water penetration
- Internal drains and vents
- Sturdy structural concrete base pad for alignment and stability

Send for **Brochure No. 35** *and name of your nearest certified contractor*

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Concrete Roofs, which will include reports on weatherproofing and sealant materials, the effect of physical factors, properties and uses of available materials, etc.

Richard G. Breeden, Jr., secy.-mgr., Pressure Sensitive Tape Council, will head the session on Pressure Sensitive Tapes for Buildings, which will discuss recent field history of tapes for sealing applications and their use in the building industry.

The third session, Selection and Field Application of Adhesives, will be chaired by D. Kenneth Sargent, dean, School of Architecture, Syracuse University. Several important papers will be presented on adhesives for ceramic, plastic and metal tile, wallboard, resilient floor coverings, insulation, plastic laminates, acoustical tile, and new field applications.

MORE MONEY GOING INTO NEW PLANTS AND RENOVATIONS

Despite the economics slowdown, U.S. manufacturers in the first quarter of 1961 were spending more on construction of new plants and renovation of old ones than they were a year ago, reports *Dun's Review and Modern Industry* in its March issue.

Thinning profit margins are behind the big push for modernization, according to 32 top business executives who spoke at the Dun & Bradstreet business magazine's editorial roundtables. It is estimated that 70 cents of every dollar industry spends on plants in 1961 will go for expansion and renovation of existing facilities to bring them to new peaks of profitability.

U. S. manufacturers will spend a probable $2.5 billion on construction of foreign plants this year. At home, they are working to get a competitive edge by investing heavily in research facilities and technical service labs where customers can watch new materials and equipment proved out under factory conditions.

(Continued on page 144)

HIGHER COMBUSTION EFFICIENCY! LOWER MAINTENANCE COSTS!

NO MOTORS, FANS OR BEARINGS IN EXHAUST LINE

PERFECT DRAFT-CONTROL BY **Quickdraft**

★ EXTREMELY HIGH NEGATIVE PRESSURES

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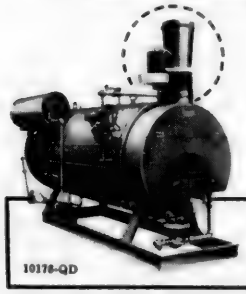
FOR INDUSTRY . . . Now you can boost the combustion efficiency of your boilers, regardless of the fuel you use. Quickdraft power-draft units provide instant controlled draft and completely remove all combustion, corrosive and noxious fumes at high temperature without passing them through the blower and motor. Maintenance costs are drastically reduced. Specify a Quickdraft unit to meet your particular requirements from a wide selection of various sizes.

FOR INSTITUTIONAL AND COMMERCIAL BUILDINGS . . . Quickdraft eliminates costly, tall and unsightly stacks. Vent incinerators, heating plants and water heaters at roof level . . . safely and efficiently.

Patents

U.S. 2,722,372 and 2,855,874
British 802,920
Canadian 593,817
Other patents pending



One of many actual installations with or without chimney.

FOR CORROSIVE SERVICE

All Quickdraft units are available in standard acid resisting vitreous enamel, 316 stainless steel, carpenter 20 rigid plastics (P.V.C), and with plastic or Fiberglas coatings.

Write for QUICKDRAFT ENGINEERING DATA on your letterhead . . . today

Quickdraft CORPORATION

P. O. Box 87-O Canton 1, Ohio

MANUFACTURERS OF ALL TYPES OF MATERIAL HANDLING UNITS WITH EXTREMELY HIGH VELOCITIES.

For more data circle item 141A

GOLD SEAL ACCESS SADDLE VALVE

U.S. PAT. NO. 2,827,913

USE WITH WATSCO CONTROL VALVE CV-1G or CV-2G

NO SCREWS! NO SEALING WASHERS!

Now a **Truly Hermetic** tube piercing valve can be soldered or brazed on refrigerant lines without removing the refrigerant!

Complete with silver solder preform, the Access Saddle Valve is available in the following O.D. tube sizes: 1/4", 5/16", 3/8", 1/2", and 5/8".

For additional information ask your wholesaler or write to Dept. V-4

WATSCO INC.

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For more data circle item 141B

Dependable Accuracy . . .

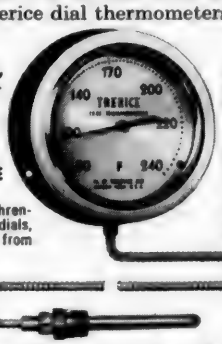
with TRERICE

DIAL THERMOMETERS

If you are after precise, dependable temperature indication, take a close look at these high-quality features of Trerice dial thermometers!

NEAT APPEARANCE, distinctive chrome-plated dial ring.

WIDE TEMPERATURE RANGES, available in both Fahrenheit and Centigrade dials, temperature ranges from -100° to 1000° F.



EASY TO READ, modern aluminum dial, large figures.

WIDE VARIETY, dial available in 2", 2½", 3½", 4½", 6", 8½" and 12" diameters with mercury, vapor, gas, solid liquid or bi-metal actuation.

All the many other standard and special option features of Trerice dial thermometers are contained in Bulletin No. 500-M. Write for your copy.

Send Bulletin 500-M.

Name .....

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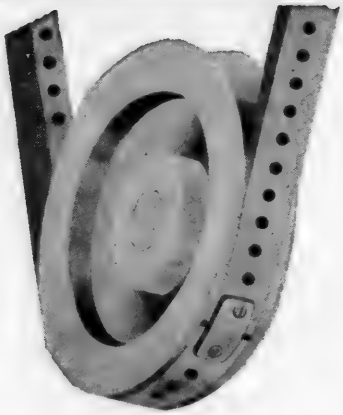
City ..... Zone ..... State .....

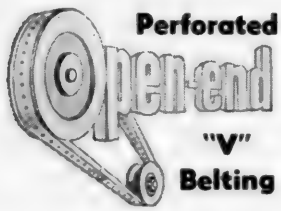
H.O. TRERICE CO. 1420-A W. Lafayette Blvd. Detroit 16, Michigan

For more data circle item 141C

NOW! MAKE YOUR OWN V BELTS WITH JUST A SCREWDRIVER!



No expensive tools, jigs, or applicators needed!



Buy your V Belts by the foot . . . at much lower cost!

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Available in sizes
O - A - B - C
Fits standard sheaves

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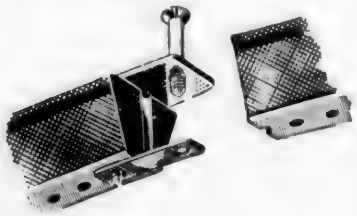
Greater horsepower, less vibration, less stretch, and longer life.



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DEGREE-DAYS FOR FEBRUARY, 1961

(A) Airport readings; (C) City office readings; (O) Readings at a point on outskirts of city

AIR CONDITIONING, HEATING AND VENTILATING'S 33rd Year of Publication of Monthly Degree-Day Data

City	February			Season to Feb. 28, from Sept. 1		
	1961	1960	Normal	1961	1960	Normal
Abilene, Tex. (A)	473	642	479	2280	2445	2250
Albany, N. Y. (A)	1101	1067	1179	5245	4809	5056
Albuquerque, N. M. (A)	678	819	714	3397	3531	3441
Alpena, Mich. (C)	1187	1319	1263	5845	5752	5448
Anchorage, Alaska (A)	1312	1223	1299	6554	6908	7188
Asheville, N. C. (C)	582	818	678	3232	3171	3105
Atlanta, Ga. (A)	429	611	512	2428	2346	2269
Atlantic City, N. J. (C)	795	800	829	3713	3218	3331
Augusta, Ga. (A)	388	546	412	2232	2080	1768
Baltimore, Md. (C)	705	779	776	3366	3082	3193
Billings, Mont. (A)	733	1145	1089	4212	5203	5133
Binghamton, N. Y. (C)	1035	1041	1100	4954	4160	4735
Birmingham, Ala. (A)	357	613	491	2323	2287	2252
Bismarck, N. D. (A)	1283	1460	1464	6063	6603	6652
Block Island, R. I. (A)	920	844	955	4015	3592	3917
Boise, Ida. (A)	661	905	868	3866	4896	4377
Boston, Mass. (A)	928	855	1002	4194	3797	4123
Buffalo, N. Y. (A)	1072	1088	1128	5027	4563	4777
Burlington, Ia. (A)	927	1208	1036	4461	4817	4641
Burlington, Vt. (A)	1297	1169	1313	5986	5457	5632
Cairo, Ill. (C)	612	826	683	3170	3188	3004
Charleston, S. C. (C)	326	445	363	1724	1592	1466
Charlotte, N. C. (A)	(a)	644	577	(a)	2540	2555
Chattanooga, Tenn. (A)	486	748	588	2934	2794	2693
Cheyenne, Wyo. (A)	923	1301	1044	4756	5415	5109
Chicago, Ill. (A)	853	1132	1053	4346	4574	4648
Cincinnati, O. (C)	676	922	812	3467	3442	3465
Cleveland, O. (A)	930	1023	1019	4730	4151	4322
Columbia, Mo. (A)	768	1062	876	3677	4109	3934
Columbia, S. C. (A)	412	557	443	2270	2159	1889
Columbus, O. (C)	760	987	907	4084	3892	3953
Concord, N. H. (A)	1121	1032	1226	5531	4866	5457
Concordia, Kans. (C)	813	1176	899	3804	4561	4091
Dallas, Tex. (A)	382	637	432	2011	2221	1909
Denver, Colo. (A)	828	1159	924	4286	4710	4397
Des Moines, Ia (A)	970	1316	1092	4636	5261	4877
Detroit, Mich. (A)	950	1081	1072	4526	4469	4600
Devils Lake, N. D. (C)	1381	1648	1576	6850	7487	7237
Dodge City, Kans. (A)	758	1147	840	3596	4316	3867
Dubuque, Ia. (A)	979	1313	1187	5171	5580	5366
Duluth, Minn. (A)	1261	1488	1448**	6560	6932	6677**
El Paso, Tex. (A)	473	534	445	2457	2270	2201
Ely, Nev. (A)	925	1200	1033	4872	5654	5199
Escanaba, Mich. (C)	1169	1252	1327	5669	5672	5856
Evansville, Ind. (A)	706	932	770	3675	3621	3424
Fairbanks, Alaska (A)	1948	1798	1907	9736	9898	10155
Fargo, N. D. (A)	1292	1548	1518	6603	6816	6851
Fort Smith, Ark. (A)	535	796	571	2744	2917	2619
Fort Wayne, Ind. (A)	915	1115	1036	4646	4564	4601
Fort Worth, Tex. (A)	409	639	446	2105	2270	1958
Fresno, California (A)	369	443	400	2209	1922	2040
Galveston, Tex. (C)	234	400	247	1180	1295	1005
Grand Junction, Colo. (A)	774	1026	924	4001	4541	4488
Grand Rapids, Mich. (A)	997	1157	1154	4816	4857	5033
Green Bay, Wisc. (A)	1109	1286	1336	5607	5775	5887
Greensboro, N. C. (A)	607	756	672	3159	3040	2991
Greenville, S. C. (A)	480	646	552	2518	2562	2425
Harrisburg, Pa. (A)	871	885	921	4242	3763	3943
Hartford, Conn. (A)	983	909	1050	4737	4255	4494
Havre, Mont. (A)	982	1329**	1291**	5201	5989**	6044**
Helena, Mont. (A)	789	1192	1165	4961	6048	5881
Houston, Tex. (C)	224	427	240	1226	1400	1083
Huron, S. D. (A)	1269	1545	1327	6224	6322	5927
Indianapolis, Ind. (A)	861	1064	938	4399	4282	4201
Jackson, Miss. (A)	336	620	405	2057	2205	1822
Juneau, Alaska (A)	932	911	1056	4991	5059	5571
Kansas City, Mo. (A)	732	1056	851	3519	3970	3811
Knoxville, Tenn. (A)	507	759	630	2998	2892	2844
La Crosse, Wisc. (A)	1040	1250	1280	5270	5538	5708
Lander, Wyo. (A)	997	1324	1179	5442	6044	5982
Lewiston, Me. (O)	1119	1026	1243	5456	4844	5532
Lincoln, Nebr. (C)	899	1292	1000	4196	4962	4483
Little Rock, Ark. (A)	480	723	543	2749	2667	2441
Los Angeles, Calif. (C)	111	224	244	578	713	1023

a) Data not available.
* Includes July and August.
** Figures based on City office readings.

Normal figures in this table are based on 30-year period covering 1921 to 1950, inclusive, as compiled and published by the U. S. Weather Bureau.

Figures in this table, with two exceptions, based on local weather bureau reports. Exceptions are Utica and Lewiston, figures for which are furnished through the courtesy of Coke Sales Department, Central New York Power Co., Utica, N. Y., and Norman E. Ross, Bursar, Bates College, Lewiston, Me., respectively.

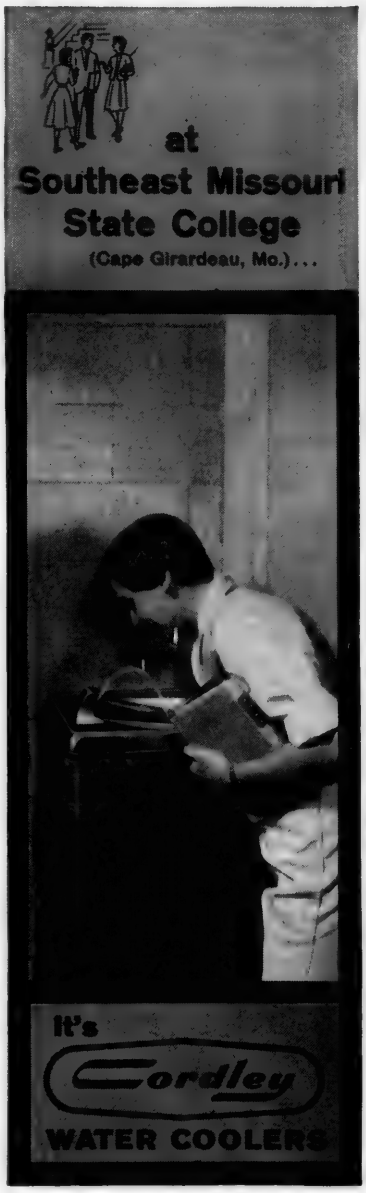
Degree-Days for February, 1961 (Concluded)

(A) Airport readings; (C) City office readings; (O) Readings at a point on outskirts of city

AIR CONDITIONING, HEATING AND VENTILATING'S 33rd Year of Publication of Monthly Degree-Day Data

City	February			Season to Feb. 28, from Sept. 1		
	1961	1960	Normal	1961	1960	Normal
Louisville, Ky. (A)	721	897	778	3760	3392	3444
Lynchburg, Va. (A)	681	808	722	3422	3231	3193
Macon, Ga. (A)	316	500	391	1996	1909	1712
Madison, Wisc. (A)	1018	1305	1207	5297	5538	5331
Marquette, Mich. (C)	1119	1253	1291	5603	5730	5737
Memphis, Tenn. (A)	489	691	574	2700	2666	2547
Meridian, Miss. (A)	330	598	413	2117	2214	1930
Milwaukee, Wisc. (A)	978	1200	1142	5099	5163	5089
Minneapolis, Minn. (A)	1184	1364	1310	5963	5871	5862
Moline, Ill. (A)	954	1229	1075	4692	4936	4797
Montgomery, Ala. (A)	302	500	388	2059	1914	1769
Nashville, Tenn. (A)	501	845	636	3066	3045	2786
New Haven, Conn. (A)	932	871	1005	4386	3870	4263
New Orleans, La. (C)	162	366	223	1094	1278	993
New York (Central Park)	788	843	904	3741	3468	3670
New York (La Guardia A)	784	(a)	907	3606*	(a)	3631*
New York (International A)	831	(a)	(a)	3733*	(a)	(a)
Newark, N. J. (A)	814	827	932	3924	3449	3883
Norfolk, Va. (A)	595	679	644	2900	2580	2630
North Platte, Nebr. (A)	914	1310	1016	4615	5536	4851
Oak Ridge, Tenn. (C)	513	797	689	3116	2968	3110
Oakland, Calif. (A)	329	373	400	1941	1677	2029
Oklahoma City, Okla. (A)	618	877	630	2860	3271	2840
Omaha, Nebr. (A)	942	1319	1058	4346	5108	4728
Parkersburg, W. Va. (C)	696	930	826	3733	3625	3599
Peoria, Ill. (A)	922	1183	1028	4670	4725	4580
Philadelphia, Pa. (C)	734	771	837	3458	3185	3394
Phoenix, Ariz. (A)	259	506	275	1198	993	1255
Pittsburgh, Pa. (C)	784	934	879	3935	3653	3761
Pittsfield, Mass. (A)	1101	1102	1212	5461	5053	5415
Portland, Me. (A)	1140	1040	1218	5498	4892	5367
Portland, Ore. (C)	463	588	594	2604	3023	2985
Providence, R. I. (A)	955	861	1019	4460	4008	4339
Pueblo, Colo. (A)	824	1166	865	4001	4761	4248
Raleigh, N. C. (A)	559	704	577	2914	2777	2434
Rapid City, S. D. (A)	884	1325	1151	4674	5537	5314
Reading, Pa. (C)	838	846	902	4014	3560	3785
Red Bluff, Calif. (A)	365	434	423	1997	1878	1982
Reno, Nev. (A)	674	832	804	4026	4469	4190
Richmond, Va. (A)	632	737	708	3259	3045	3068
Rochester, N. Y. (A)	1045	1122	1148	4917	4757	4870
Roswel, N. M. (A)	627	716	566	3366	3054	2768
Sacramento, Calif. (C)	328	382	403	1994	1852	1997
St. Joseph, Mo. (C)	830	1142	820	3986	4486	3646
St. Louis, Mo. (C)	714	969	792	3394	3664	3478
Salt Lake City, Ut. (A)	743	1049	885	4113	4809	4358
San Antonio, Tex. (A)	272	433	293	1407	1635	1355
San Diego, Calif. (A)	160	228	247	711	721	1042
Sandusky, O. (C)	886	1059	997	4350	4252	4235
San Francisco, Calif. (C)	262	305	336	1749	1329	1679
Sault Ste. Marie, Mich. (A)	1279	1379	1442	6171	6136	6369
Savannah, Ga. (A)	295	441	330	3457	1668	1429
Scranton, Pa. (A)	1005	1024	1028	4996	4421	4423
Seattle, Wash. (C)	503	581	602	2726	2978	3037
Sheridan, Wyo. (A)	862	1301	1170	4871	5808	5607
Shreveport, La. (A)	342	608	386	1921	2171	1784
Sioux City, Ia. (A)	1107	1431	1170	4975	5637	5301
Spokane, Wash. (A)	775	990	988	4570	5366	4936
Springfield, Ill. (A)	877	1114	907	4249	4317	4021
Springfield, Mo. (A)	728	968	790	3503	3779	3624
Syracuse, N. Y. (A)	1091	1096	1117	4964	4676	4682
Toledo, O. (A)	(a)	1078	1056	(a)	4641	4617
Topeka, Kans. (C)	816	1113	851	3829	4355	3830
Trenton, N. J. (C)	815	828	904	3927	3497	3760
Tulsa, Okla. (A)	619	864	644	2857	3138	2882
Utica, N. Y. (O)	1003	1040	1181	4352	4376	4966
Valentine, Nebr. (A)	977	1451	1100	4980	5849	5170
Walla Walla, Wash. (C)	495	719	748	3300	4022	3737
Washington, D. C. (A)	740	766	770	3577	3085	3258
Wichita, Kans. (A)	770	1048	778	3526	3934	3564
Williston, N. D. (C)	1186	1511	1442	5882	6708	6642
Winnemucca, Nev. (A)	791	959	854	3250	5035	4602
Yakima, Wash. (A)	673	860	862	4208	4731	4512

For footnotes, see page 142.



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More Cooler Experience. Water Coolers are Cordley's *only* business, not a side line.

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More Help in choosing the right coolers for your use...from Cordley's line of 28 job-rated models. 4196

The New CORDWALL LINE

No plumbing shows. Flush to the wall. No dirt can get behind. 3 wall models for installation at any height. 5 floor models. See Yellow Pages for nearest Cordley Distributor. Ask for Catalog 61.

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Specialists in water cooling since 1889

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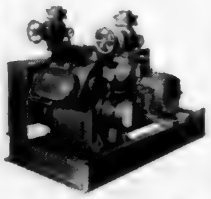
Summer Cooling... Winter Curling and Skating - all with ONE refrigeration system

Main entrance to Prudhomme's Garden Centre Motor Hotel in Vineland, Ontario. This exciting summer and winter playground spot uses Vilter refrigeration to good advantage.



Two 6-cyl. Vilter VMC belt-driven compressors provide refrigeration at Prudhomme's for summer air conditioning and winter curling.

The Garden Centre Theatre becomes a regulation six-sheet curling rink during the winter months. The Vilter system is designed to produce ideal curling ice at the lowest possible power cost.

Year 'round use of your refrigeration capacity is sound business and enables maximum profit to be realized from your investment.

An excellent example of the year-'round utilization of refrigeration is Prudhomme's Garden Centre Motor Hotel in Vineland, Ontario, along the Queen Elizabeth Way. At this famous motel, recreation center and convention headquarters, Vilter refrigeration plays an important role in keeping guests happy.

During the summer months, refrigeration is required to air condition the 180-room motel, one of Canada's largest, and an 1100-seat summer stock theatre which draws large crowds to see outstanding stock productions of Broadway plays. In winter months, the same equipment builds ice surfaces for a 90′ x 180′ outdoor ice skating rink and a regulation six-sheet curling rink. The summer stock theatre building is used to house the curling rink with either a seating structure installed or plastic piping laid for the curling rink, depending upon the season.

Vilter equipment installed at Prudhomme's includes two 6-cylinder VMC compressors and a 24″ x 20′ shell and tube condenser.

Vilter has had many years of experience in recommending and building refrigeration systems for air conditioning and ice rinks. This know-how, plus the use of dependable economical-to-operate Vilter equipment, can also mean a satisfying installation for you. Why not see your nearest Vilter representative today?

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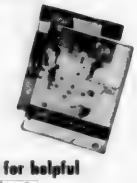
J. L. Wilson and Sons, Limited, Toronto, Ontario, Canada

Vilter® refrigeration air conditioning

The Vilter Manufacturing Company
Milwaukee 7, Wisconsin

Air Units • Ammonia and Freon Compressors • Booster Compressors Baudelot Coolers • Water and Brine Coolers • Blast Freezers Evaporative and Shell and Tube Condensers • Pipe Coils Valves and Fittings • Pakice and Polarflake ice machines.



Write for helpful bulletins to The Vilter Manufacturing Company, Dept. G-614 2217 South First Street Milwaukee 7, Wisconsin

For more data circle this page number on card at back of book

TREND IS REVERSING

For the first time in three years there has been only a slight decline in engineering enrollment in institutions having curriculums accredited by the Engineers Council of Professional Development, according to Wayne E. Tolliver and Dr. Henry H. Armsby of the U. S. Office of Education. Freshmen enrollments in these institutions in the fall of 1960 were slightly larger (1.2%) than in the fall of 1959, they report. Within the next year or two, total undergraduate engineering enrollments may once again show annual increases.

DESIGN, DRAFTING SEMINAR

Oklahoma State University, Stillwater, will be the scene of the 1961 Design and Drafting Seminar sponsored by the American Institute for Design and Drafting, on May 19 and 20.

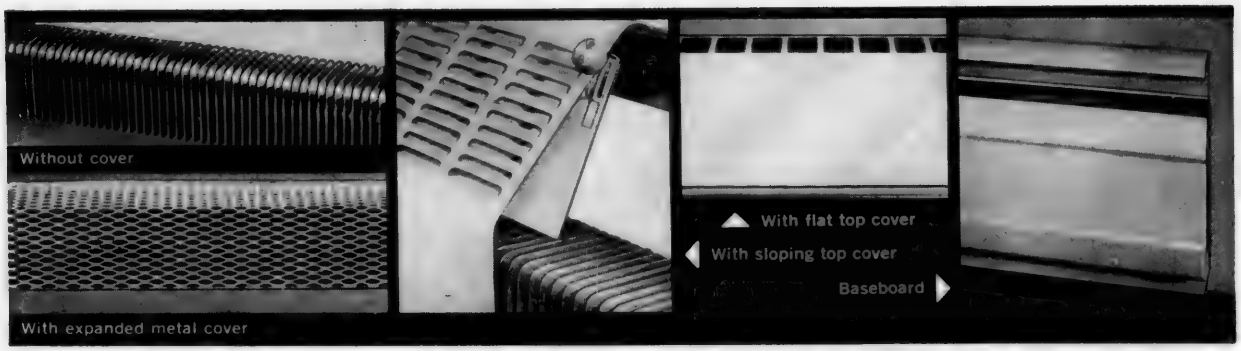
Designed to attract chief draftsmen, chief designers, supervisors of drafting, educators and other top personnel of the design and drafting areas of America's industries and educational institutions, the two day program will cover standards, training of design/drafting personnel, microfilming, reproductions and photodrawings.

Complete information on details of the Seminar may be secured by writing American Institute for Design and Drafting, 18465 James Couzens Highway, Detroit, Mich.

AC&R EXPORTS INCREASE 28%

U. S. air conditioning and refrigeration products are making substantial sales gains in all parts of the world and will continue to do so in the future, according to N. A. Gardner, international air conditioning manager for Worthington Corp. and chairman of the American Refrigeration Institute's Foreign Trade Committee.

Mr. Gardner said that export sales of U. S. air conditioning and refrigeration equipment manufacturers were about 28% higher in 1960 than in 1959. He attributed this increase to growing industrialization in many counties.



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Choose the finned tube radiation that best meets your requirements—from the complete Sarcofin line. Choice of 32 different heating elements. Eight types of enclosures: flat-top, expanded metal, sloping top, modified flat top, sill-type and three baseboard cover types.

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STRAINERS • HEATING SPECIALTIES

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ALKASERTS are erosion-resistant, polyethylene inserts which push-fit easily, securely in inlet ends of new or old condenser tubes. No adhesive needed to install. Flexible, dimensionally stable at 70°C. (158°F.).

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For more data circle item 145A

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SPRAY NOZZLES

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For complete information write for Roof Cooling Bulletin 81.

SPRAYING SYSTEMS CO.
3261 Randolph • Bellwood, Illinois

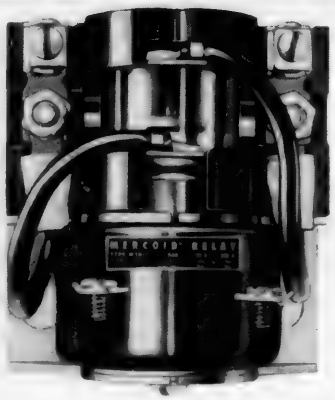
ADVANCED SPRAY NOZZLE DESIGN FOR NEW DIMENSIONS IN CONTROL AND PERFORMANCE

For more data circle item 145B

35 AMP

Plunger Type

MERCOID MERCURY RELAY



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WRITE FOR BULLETIN 0-20

THE MERCOID CORPORATION,
4209 Belmont Ave.,
Chicago 41, Ill.

For more data circle this page number on card

BRIEFLY STATED NEWS ITEMS

William O. Huebner has left Anemostat Corporation and will set up his own office as consultant, writer and editor. He has written every issue of the company's publication "Aspiration" and served as the company's technical editor generally. An active ASHRAE member, he is a graduate in mechanical engineering of Technical University, Berlin. Mr. Huebner resides at 935 Lyman Ave., Peekskill, New York.

INSTITUTES AND ASSOCIATIONS

Harold P. King, will be installed as president of the CONSULTING ENGINEERS COUNCIL, at the fifth annual board of directors meeting, May 4-6, in the Executive House in Chicago. He succeeds Hueston M. Smith. The president-elect is a structural engineer and partner in the Sherman Oaks, Calif., consulting firm of King, Benioff & Associates. Other officers to be installed include Cedric Robert Acheson, Syracuse, N. Y., as first vice-president. He is a consulting mechanical and electrical engineer, specializing in mechanical and electrical design for buildings and a partner in the firm of Crenshaw, Beardsley & King. He is a former president of New York State Association of Consulting Engineers.

Hueston M. Smith, St. Louis, was honored recently with a "Certificate of Merit" from the City of New Orleans in recognition of an outstanding job done as national president of CEC. The presentation was made at the annual meeting of the Gulf Institute of Consulting Engineers in New Orleans, where Mr. Smith was featured speaker. Presented with a similar award for his work as area president was Warren G. Moses, New Orleans, retiring president of the Gulf Institute of Consulting Engineers. Presentations were made by New Orleans City Councilman Glenn P. Clasen, representing Mayor deLesseps S. Morrison. Mr. Moses was succeeded as president by C. Carter Brown of Brown & Butler, Baton Rouge consulting engineer firm.

OIL HEAT INSTITUTE OF AMERICA, at a special membership meeting, approved overwhelmingly the merger of Oil Heat Institute of America and NATIONAL FUEL OIL COUNCIL into one national organization to represent and promote the interests of the heating oil industry. Voted out of existence, the Institute would have been 40 years old this month. . .

The annual meeting of PLUMBING AND DRAINAGE INSTITUTE was held in Chicago on February 9. The following industry members were elected directors: Earl L. Morris, Acorn Engineering Co., Los Angeles; William K. Child, Norman Boosey Mfg. Co., Racine, Wis.; M. J. Hirshstein, Josam Mfg. Co., Michigan City, Ind.; Jay R. Smith, Jay R. Smith Mfg. Co., Union, N. J.; and Melvin A. Zurn, Zurn Industries, Inc., Erie, Pa. At the directors meeting immediately following, Mr. Smith was elected president; Mr. Child, vice-president. J. Scott Parrish, Jr., was re-elected executive vice-president. . .

E. Peter Sorensen, president of Airo Supply Co., Chicago, was elected president of AIR CONDITIONING AND REFRIGERATION WHOLESALERS association. He will serve the year of 1961. Mr. Sorensen is the 26th president of this association, which represents 491 wholesale locations throughout the world. He is one of the founders of ARW and has actively served the association in many capacities.

BURGEONING BUSINESS

WEIL-MCLAIN COMPANY, INC., Michigan City, Ind., has announced the formation of a Canadian affiliate, Weil-McLain (Canada) Limited, located in Toronto, Ontario. A joint stock company with substantial Canadian participation, they will produce and distribute, through recognized plumbing and heating wholesalers, residential and commercial cast iron boilers and radiation. . .

Completion of a new building

containing 32,000 sq. ft of manufacturing space was announced by BELL & GOSSETT CO., Morton Grove, Ill. . .

GUSTIN-BACON MANUFACTURING CO., Kansas City, Mo., has announced a multi-million-dollar expansion of production facilities which has greatly increased the output of the company's industrial, commercial and residential fiber glass insulation products. . .

ROBERTS-GORDON APPLIANCE CORPORATION, Buffalo, N. Y., 35-year old manufacturer of residential and industrial gas heating equipment, announces its acquisition by A. J. INDUSTRIES, INC., Los Angeles, through an exchange of common stock of the two companies. Roberts-Gordon will continue its operations under its present management as a subsidiary of A. J. Industries, with no anticipated changes in practices, except that considerably greater emphasis will be given to expansion of product lines. . .

VILTER MANUFACTURING COMPANY, Milwaukee, Wis., announced the opening of a new sales office in Los Angeles to more effectively serve its California customers. Joseph M. Lutes has been named district manager of the new office, and will direct the sale of refrigeration, air conditioning and heat transfer equipment throughout California, Arizona and Nevada. . .

PARAGON ELECTRIC COMPANY, Two Rivers, Wis., announces its affiliation with AMERICAN MACHINE & FOUNDRY COMPANY as a subsidiary under its Electrical Products Group, effective February 3, 1961. Paragon will continue the development and manufacture of its present time control line under the new name, PARAGON ELECTRIC COMPANY, INC. Management under the direction of President George J. Platt will remain in Two Rivers. . .

REPUBLIC-TRANSCON INDUSTRIES, INC., manufacturers of water heaters and other appliances, is purchasing THE MATHES COMPANY DIVISION OF GLEN ALDEN CORPORATION, manufacturer of residential, commercial, and

DRY and CLEAN AIR at the RIGHT TEMPERATURE

For Processes or Material Demanding Precise Control, Use Niagara Liquid Absorbent Air Conditioning.

This compact method, giving high capacity in small space, removes moisture from air by contact with a liquid in a small spray chamber. The liquid spray contact temperature and the absorbent concentration, factors that are easily and positively controlled, determine exactly the amount of moisture remaining in the air.

Most effective because . . . it removes moisture as a separate function from cooling or heating and so gives a precise result, and always. Niagara machines using liquid contact means of drying air have given over 20 years of service. The apparatus is simple, parts are accessible, controls are trustworthy.

Most reliable because... the absorbent is continuously reconcentrated automatically. No moisture-sensitive instruments are required to control your conditions...no solids, salts or solutions of solids are used and there are no corrosive or reactive substances.

Most flexible because...you can obtain any condition at will and hold it as long as you wish in either continuous production, testing or storage.

Write for Bulletins 112 and 131 and complete information on your air conditioning problem.

NIAGARA BLOWER COMPANY

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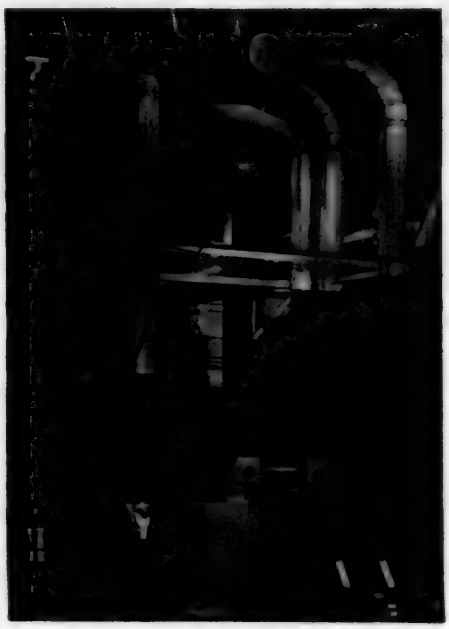
Niagara District Engineers in Principal Cities of U.S. and Canada

For more data circle Item 147A

YOU SAVE MORE WITH FLEXAUST® HOSE



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For more data circle Item 147B

industrial air conditioning and heating equipment. . .

IRON FIREMAN MFG. CO., Cleveland, Ohio, announced it has expanded its operations in the package generator field. As part of this expansion, the company has launched the production of a completely new line of package generators. This new series will carry the Iron Fireman label only—and Iron Fireman alone will be responsible for its design, workmanship and materials. The company's established network of experienced franchised dealers will be responsible for sales and servicing. To head this expanded operation, Iron Fireman has appointed Gilbert Nelligann to the newly created post of sales manager-package generator department. Mr. Nelligann is a 30-year veteran of the heating industry with many years of experience in the engineering and sales of boilers and package generators. . .

Formation of DANFOSS INC., Lodi, N. J., a new American corporation, which will supply quality equipment and controls for the air conditioning, heating and refrigeration industries, was announced. Recently incorporated in the State of New York, the new concern is a subsidiary corporation of Danfoss of Denmark, manufacturer of equipment and controls for the air conditioning, heating and refrigeration fields. Equipment manufactured includes compressors, fuel pumps and electrical starters. Control products include a complete line of temperature and pressure devices such as expansion valves, solenoids and thermostats. The new American corporation will introduce a product line specifically designed for and competitive in American markets. For the present, manufacture will be in Denmark. . .

HUPP CORPORATION, Cleveland, Ohio, has realigned its organization structure along group lines to effect closer liaison between the corporate staff and a rapidly increasing number of operating divisions. Hupp now has thirteen operating divisions, five of which have been added through acquisition since mid-1960. To reduce the number of divisions reporting directly to the president, two group vice presidents have been elected. They are Anthony J. De Fino, vice-president and general manager of the Perfection Division, and Robert N. Ward, assistant to the president. . .

Contracts for building the new West Coast manufacturing plant for MCQUAY, INC., at Visalia, Calif., are being let, and the appointment of Harold T. Hunt as plant manager was announced. Construction of the new plant will begin immediately. . .

A Caribbean sales office, located in San Juan, Puerto Rico, has been established by THE TRANE COMPANY, La Crosse, Wis.

ASSURANCE OF PROPERLY RATED PERFORMANCE IN
AIR MOVING DEVICES
CERTIFIED RATINGS
Certified Ratings are the result of tests made by the manufacturer in accordance with Standard Test Codes adopted by the Air Moving and Conditioning Association, Inc., successor to Industrial Unit Heater Association, National Association of Fan Manufacturers, Inc., and Power Fan Manufacturers Association.
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AMCA
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IT'S WHAT'S BEHIND THE SEAL...THAT REALLY COUNTS

AMCA IS BEHIND THIS SEAL—Only manufacturers who meet the rigid requirements for testing and rating air moving devices under the certified ratings program are licensed by AMCA to use the Certified Ratings Seal.

PROPERLY-RATED PERFORMANCE IS BEHIND THIS SEAL—Only performance rating data developed in accordance with AMCA standard test codes, and based on tests conducted only in AMCA-approved laboratories is accepted for review and license consideration under the certified ratings program.

A CONTINUING RE-TEST PROGRAM IS BEHIND THIS SEAL—All products licensed to use the certified ratings seal are subject to periodic re-evaluation under AMCA's continuing re-test program, and license to use the Seal may be withdrawn by AMCA for non-conformance with requirements.

For a list of manufacturers participating in AMCA's certified ratings program, write: Air Moving and Conditioning Association, Inc., 2159 Guardian Building, Detroit 26, Michigan.

For more data circle this page number of card at back of book

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Clean air, free of dirt and dust particles, reduces operating costs, increases employee efficiency. Be sure to provide for clean air in your installations—and remember, the finest filters are sold by members of the Air Filter Institute . . .

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Air-Maze Corporation
25000 Miles Road
Cleveland 28, Ohio

American Air Filter Co., Inc.
215 Central Avenue
Louisville 8, Kentucky

Continental Air Filters, Inc.
2520 Helm Street
Louisville 9, Kentucky

Dollinger Corporation
11 Centre Park
Rochester 3, New York

Drico Industrial Corporation
100 Eighth Street
Passaic, New Jersey

Fram Corporation
Providence 16, Rhode Island

Minneapolis-Honeywell Regulator Co.
Minneapolis 8, Minnesota

Owens-Corning Fiberglas Corporation
1833 National Bank Building
Toledo 3, Ohio

Pittsburgh Plate Glass Company
Fiber Glass Division
One Gateway Center
Pittsburgh 22, Pennsylvania

Research Products Corporation
1015 E. Washington Avenue
Madison 10, Wisconsin

*Technical Filter Co.
2719 South Poplar Avenue
Chicago 8, Illinois

Trion, Inc.
1000 Island Avenue
McKees Rocks, Pennsylvania

Union Carbide Development Co.
270 Park Ave.
New York 17, N. Y.

Vortox Company
121 S. Alexander Avenue
Claremont, California

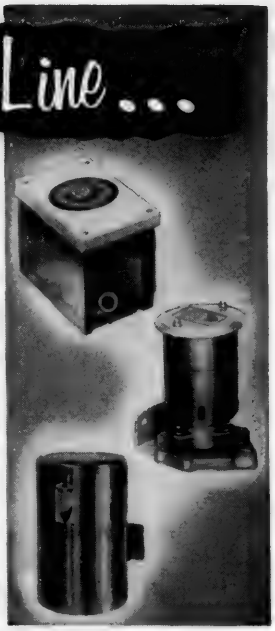
Westinghouse Electric Corporation
Sturtevant Division
Hyde Park, Boston 36, Massachusetts

*Formerly Wilson & Co., Inc.

For more data circle item 149A

A Complete Line . . .

LOW COST
CONDENSATE
DISPOSAL PUMPS
designed for
AIR CONDITIONING
AND REFRIGERATION



MODEL AB-F
"All-Plastic" low cost unit. 9 ft. V., lift. 300 ft. H. run. In-pan installation. Sump available when required.

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For CLOSE-TO-FLOOR, low inlet connection. 21 ft. V. lift. 300 ft. H., run. Packaged unit. Long life.

MODEL C21-F
Extra Heavy Duty pump, with sump and float switch built in. Trouble-free service. 21 ft. V. lift. 300 ft. H. run.

ALL MARCH PUMPS ARE FURNISHED WITH 110/220 VOLT MOTORS. FACTORY TESTED AND READY TO RUN. MINIMUM INSTALLATION COSTS.

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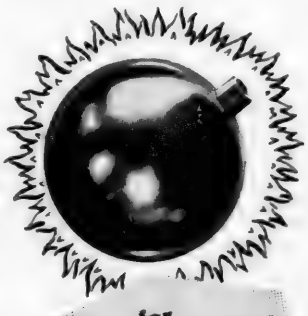
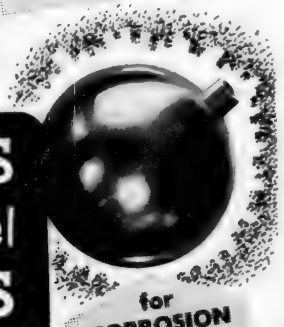
INCORPORATED
CONDENSATE PUMPS FOR AIR CONDITIONING EQUIPMENT
7300 MONTICELLO AVENUE • SKOKIE, ILLINOIS

For more data circle item 149C



for HIGH TEMPERATURE

for HIGH PRESSURE



for CORROSION RESISTANCE

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Write for Catalog

ARTHUR HARRIS & CO.
Established 1874
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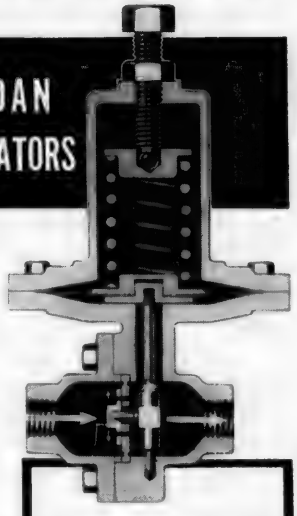
CUT MAINTENANCE

with OPW-JORDAN SLIDING GATE REGULATORS



- Self-lapping and self-cleaning stainless steel seats prevent build-up of foreign matter—minimize maintenance.
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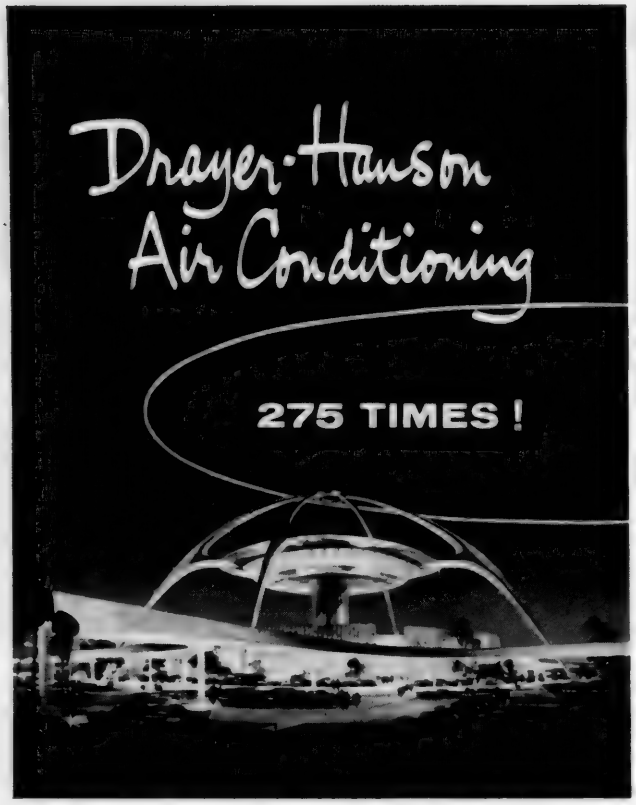
For more data circle item 149D



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(Brochure GAC 150.01 tells you why)

drayer-hanson

DIVISION OF
HI-PRESS AIR CONDITIONING OF AMERICA, INC.
3301 Medford Street, Los Angeles 63, California
(Cable: Cliconi, Los Angeles)

What Readers Say:

(Continued from page 10)

4. The check valve vacuum breakers are shown backwards. If you insist on the thermostatic bypasses in addition to the F & T traps, then the thermostatic trap can serve as the vacuum breaker and the check is superfluous.
5. The vacuum breaker device might better be installed at the coil inlet.
6. With a strainer ahead of the F & T trap, the dirt pocket could be deleted.
7. For the coil F & T trap (or traps if I had my way) the coil headers themselves act as pretty satisfactory dirt pockets, so the dirt pocket on the drop leg at the trap inlet ought to be enough protection to permit deleting the strainer ahead of that trap.
8. The gate valve ahead of the coil trap is useless because coil inlet steam valves would have to be turned off anyway for servicing.
9. If there is need in the system for a gate valve following the coil trap assembly, then a gate valve is also necessary following the end of the main F & T trap.
10. On the reheat coil hookup, neither the vacuum breaker check nor the thermostatic bypass should be necessary on a gravity return.

If you want to start some further arguments, just show diagrams for coils with the tubes vertical!

Richard M. Stern

Richard M. Stern
Consulting Engineers
Seattle, Wash.

Other letters with constructive criticism regarding the detail sheet on steam heated coil hookups were received from the following readers:

John J. Jourdan
Charles J. R. McClure and Associates
Consulting Engineers
St. Louis, Mo.

Evart W. Powers
Service and Installation Manager
Commercial Division
Minneapolis-Honeywell Regulator Co.
Dayton, Ohio

E. M. Mittendorff
Deputy Chief
Industry and Transportation Div.
U.S.A. Operations Mission to Iran
Tehran, Iran

BOOK REVIEWS

Publications abstracted in this department should be ordered direct from publisher.

CENTRIFUGAL PUMPS

Covering selection, operation and maintenance, Centrifugal Pumps was prepared as a reference book for users and designers of such units. The authors are Igor J. Karassik, consulting engineer, Worthington Corp., and the late Roy Carter.

An objective of the authors is to guide the centrifugal pump user in a system design and satisfactory equipment selection. Complex technical explanations were avoided and involved theoretical discussions omitted.

Data presented apply to all makes and types of centrifugal pumps. The illustrations used have been selected from a wide group of manufacturers.

The text is divided into five main sections, each consisting of several chapters. The sections cover these topics: Pump Types and Construction; Pump Performance; Controls, Drivers and Priming; Services and Selection of Pumps; Installation, Operation and Maintenance.

Centrifugal Pumps, by I. J. Karassik and R. Carter. Cloth bound, 7 x 10 inches, 488 pages. Published by F. W. Dodge Corp., 119 W. 40th St., New York 18, N. Y. Price, $15.75.

SANDWICH PANEL DESIGN—One of the programs of the BRI Fall Conference held in 1959 was devoted to Sandwich Panel Design Criteria. All the papers that were part of this program, and the discussions of the papers are now available as BRI Publication 798. Building Research Institute, 2101 Constitution Ave., Washington 25, D. C. Price, $8.

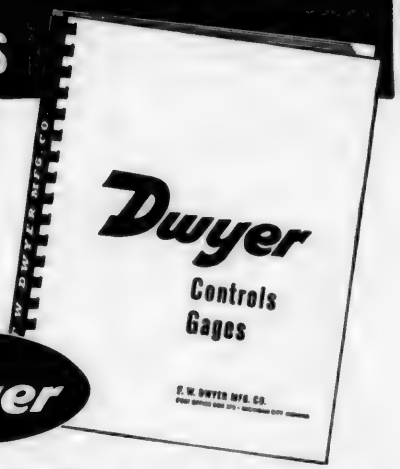
BASEBOARD RATINGS — All I-B-R baseboard ratings in effect on September 15, 1960, are contained in a new I-B-R Baseboard Ratings booklet. It contains ratings of 113 units offered by 55 companies. All baseboards listed have been tested in the I-B-R laboratory. The Institute of Boiler and Radiator Manufacturers, 608 Fifth Ave., New York 20, N. Y. Price 75 cents.

AIR POLLUTION IN MINNESOTA—In the light of all available information, Minnesota does not now have a severe air pollution problem when considering the state as a whole, but localized problems do exist. Those who are particularly interested in the problems of that state, or who might otherwise benefit from a well-documented "Appraisal of Air Pollution in Minnesota" will find this report of the Minnesota Department of Health rewarding. Included are data on air pollution sources, fuel consumption in the state, degree-days, dustfall, topography of the state, and population statistics. Copies are available from the library of the Robert A. Taft Sanitary Engineering Center, U.S. Public Health Service, Cincinnati 26, Ohio. There is no charge.

(Continued on next page)

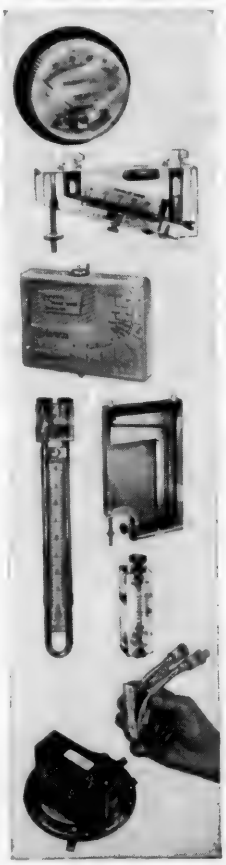
For the latest in Gages... Controls

check the new Dwyer



INSTRUMENT MANUAL

Need a meter for *direct* reading of both air velocity and static pressure? An inexpensive gage that tells homeowners when to change air filters? A complete, accurate combustion test kit, or a manometer that *rolls* up to fit compactly in your tool box? You'll find these and many more money-saving ideas described in this free Dwyer manual. It's packed full of valuable information about Dwyer's complete line of instruments.



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(Continued from page 151)

GAS TURBINES FOR SCHOOLS—"A New Look at New Schools," the gas industry's research report on use of gas turbines to supply all energy requirements in the modern secondary school, is available from Southern Gas Association, 1524 Life Building, Dallas 2, Tex. Prices are $1.50 for a single copy. Prepared by Golemon & Rolfe, architects and engineers, Houston, Tex., the study was prompted by an earlier report, "Environment for Learning," prepared by the same firm and sponsored by Carrier Corporation. The latter report set forth that a saving of up to 20% in first cost was possible in building a compact, completely air conditioned, secondary school using purchased electrical power for heating and cooling. The compact school cost more to operate, however. The present pamphlet contends that use of a gas turbine will pull operating costs, too, below that of the conventional school plant. (For more details, see "A New Approach to School Design", page 85 of the March issue.)

PACKING AND GASKET HANDBOOK—Handbook of Mechanical Packings and Gasket Materials, sponsored by Mechanical Packing Association and published by McGraw-Hill, is a 106-page reference book about the products of this industry and the variety of their uses and methods of application. Includes American Standards for non-metallic gaskets for pipe flanges, recommended standards for stuffing box dimensions, and technical data on mechanical packings, gaskets, mechanical seals and piston rings. Obtainable from Mechanical Packing Association, Inc., 17 John St., New York 38, N. Y. Price $2.50.

SOVIET REFRIGERATION—Refrigeration Engineering, A Source Book of Soviet Literature, 1923-55, is a translation, for the National Science Foundation and the U.S. Department of Agriculture, of a book published by the State Publishing House for Books on Trade, Moscow.

According to its introduction, this is the only available bibliography of Russian technical literature on refrigeration engineering and it is based on what its compilers describe as a "very voluminous" amount of Soviet engineering data. This source book is divided into three main parts. Part 1 covers the technical operation and design of refrigerating plants, with sections devoted to such topics as safety, sanitation, and insulating materials. Part 2 deals with the Soviet refrigeration industry, including refrigerated transportation. The book's third part covers refrigeration techniques and *air conditioning*. An alphabetical list of Russian and foreign authors is included in each of the book's three parts.

Order (No. 60-51073) from Office of Technical Services, U.S. Department of Commerce, Washington 25, D.C. Price is $3.00.

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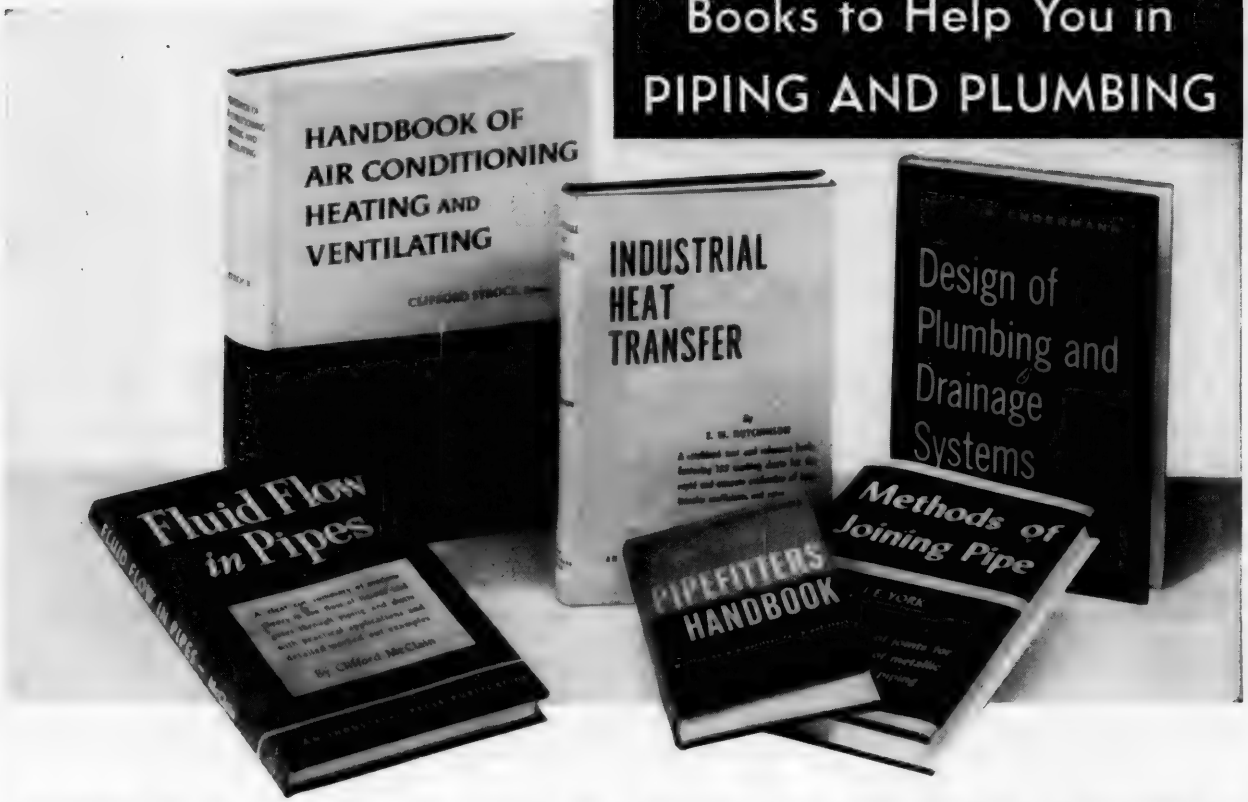
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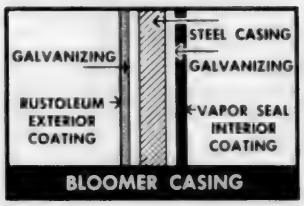

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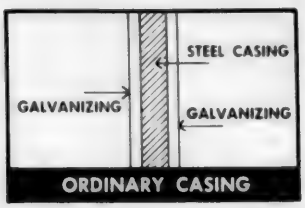

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SMALL WATER SYSTEMS—Water System & Treatment Handbook is published by The National Association of Domestic and Farm Pump Manufacturers, Inc., 20 West Street, Annapolis, Md. Text is part of the Association's public information program designed to stress advantages of private water systems. The 174-page, soft-bound book covers types of wells, standard drillers contract, plumbing layout, septic tanks, sump pumps, electric water heaters, friction charts, components of automatic systems, installation of piston pumps, jet pumps, shallow and deep well pumps, water purification and treatment, and water analysis. Price is $1.50.

AGA REFERENCE MANUAL—Said to be the first sales reference manual published on gas air conditioning, their 350-page loose-leaf Air Conditioning Sales Reference Manual, Cat. No. 112/I, is available for general circulation from American Gas Association. Containing numerous tables and illustrations, it was published originally for students at the air conditioning sales school sponsored by Gas Air Conditioning and Heating Committee of AGA. Price is $9.00. Order from Order and Billing Dept., AGA, 420 Lexington Ave., New York 17, N. Y.

COMING EVENTS

Where listed, names or titles of individuals are those from whom further information is available.

CONVENTION ON WELDING—Annual convention of the American Welding Society, The Coliseum, New York, N. Y. For information write, American Welding Society, 33 W. 39th St., New York 18, N. Y. ..... **APRIL 18-20, 1961.**

NATIONAL CONVENTION—The 39th Annual Convention of the Oil Heat Institute of America will be held at the Statler-Hilton Hotel, Washington, D. C. ..... **APRIL 23-27, 1961.**

PLASTICS CONFERENCE—18th Annual Western Section Conference of The Society of the Plastics Industry, Inc., 250 Park Ave., New York 17, N. Y., to be held at Hotel del Coronado, Coronado, Calif. Miss Kay Stewart, Director, Publicity and Press, 1961 SPI Western Section Conference, Thalco, 630 S. Kenmore, Los Angeles 5, Calif. ..... **APRIL 27-28, 1961.**

LPGA CONVENTION—30th Annual Convention and Trade Show of Liquefied Petroleum Gas Association, 11 S. LaSalle Street, Chicago 3, Ill., at Conrad Hilton Hotel, Chicago. ..... **APRIL 30-MAY 1, 1961.**

CONSULTING ENGINEERS COUNCIL—Annual meeting of the Board of Directors of Consulting Engineers Council, at Executive House, Chicago, Ill. Executive Secretary, L. N. Spiller, 326 Reisch Bldg., Springfield, Ill. ..... **MAY 4-6, 1961.**

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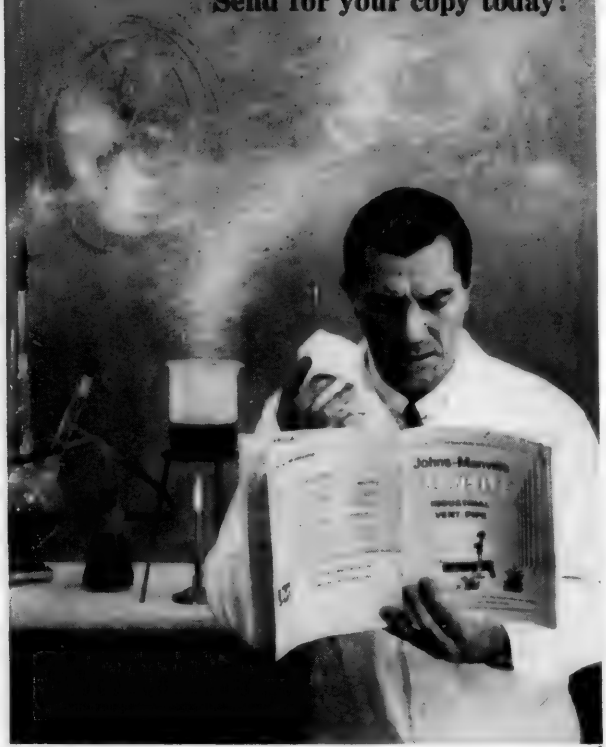

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Coming Events

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BRI SPRING CONFERENCES—Building Research Institute Spring Conference, Shoreham Hotel, Washington, D. C. BRI, 2101 Constitution Ave., Washington 25, D. C. ..... **MAY 16-18, 1961.**

DESIGN ENGINEERING CONFERENCE AND SHOW—Design Engineering Show, Cobo Hall, Detroit, Michigan. Exposition management by Clapp and Poliak, Inc., 341 Madison Ave., New York 17, N. Y. ..... **MAY 22-25, 1961.**

AIR POLLUTION CONTROL—54th Annual Air Pollution Control Association Meeting, Hotel Commodore, New York, N. Y., includes 18 technical sessions, over 80 papers, equipment exhibit. APCA, 4400 Fifth Ave., Pittsburgh 13, Pa. .... **JUNE 11-15, 1961.**

NDHA MEETING—Annual meeting of the National District Heating Association, Wentworth-by-the-Sea, Portsmouth, N. H. Secretary, John F. Collins, Jr., 827 N. Euclid Ave., Pittsburgh 6, Pa. ..... **JUNE 12-15, 1961.**

NAPC CONVENTION—79th Annual Convention, National Association of Plumbing Contractors, 1016 20th St., N.W., Washington 6, D. C., in conjunction with the 1961 National Plumbing-Heating-Cooling Exposition, Cobo Hall, Detroit, Mich. **JUNE 18-22, 1961.**

ASTM ANNUAL MEETING—Annual Meeting of the American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa., at Chalfonte-Haddon Hall, Atlantic City, N. J. .. **JUNE 25-30, 1961.**

WESTERN ENGINEERING SHOW—Western Plant Maintenance & Engineering Show and Conference, Los Angeles Pan Pacific Auditorium. Management: Clapp and Poliak, Inc., Western Office, 759 Monadnock Bldg., San Francisco 5, Calif. .. **JULY 18-20, 1961.**

AISA CONVENTION—10th Annual Convention and Business Conference, American Institute of Supply Associations, Inc., 1505 22nd St., N.W., Washington 7, D. C., to be held in San Francisco, Calif. Executive Secretary, George T. Underwood. ..... **SEPTEMBER 24-27, 1961.**

AGA CONVENTION—43rd Annual Meeting of the American Gas Association, 420 Lexington Avenue, New York 17, N. Y., at Dallas Municipal Auditorium and Statler-Hilton, Sheraton-Dallas, Adolphus and Baker Hotels, Dallas, Tex. .... **OCTOBER 1-4, 1961.**

WESTERN BUILDING INDUSTRIES EXPOSITION—Sponsored by associations of the Western Building Industries Council, to be held at Great Western Exhibit Center, Los Angeles, Calif. Management and Exhibit Sales, A. Byron Perkins & Associates, Inc., 2216 S. Hill St., Los Angeles 7. ..... **OCTOBER 7-10, 1961.**

INDUSTRIAL HYGIENE FOUNDATION—The 26th annual meeting of the Industrial Hygiene Foundation of America Inc. will be held at the Mellon Institute, 4400 Fifth Avenue, Pittsburgh 13, Pa. Dr. H. H. Schrenk, Managing Director, 4400 Fifth Avenue, Pittsburgh 13, Pa. ..... **OCTOBER 25-26, 1961.**

NATIONAL WARM AIR—The 48th Annual Convention will be held at the La Salle Hotel, Managing Director, James M. Martin. National Warm Air Heating and Air Conditioning Association, 640 Engineers Building, Cleveland 14, Ohio .... **NOVEMBER 6, 1961.**

BRI FALL CONFERENCES—Building Research Institute Spring Conference Shoreham Hotel, Washington, D. C. BRI, 2101 Constitution Ave., Washington 25, D. C. .... **NOVEMBER 14-16, 1961.**

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Coming Events

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ARI EXPOSITION—Air Conditioning and Refrigeration Institute, 12th Exposition. Pan-Pacific Auditorium, Los Angeles. Information: George E. Mills, ARI Show Director, 1346 Connecticut Ave. N.W. Washington 6, D. C. .....**FEBRUARY 12-15, 1962.**

ELECTRIC HEATING SHOW—The Second National Electric House Heating Symposium and Exposition, sponsored by Electric House Heating Section, National Electrical Manufacturers Association, 155 East 44th Street, New York 17, N. Y., to be held at the Sherman Hotel, Chicago, Ill. Write Russell Gingles, NEMA director of public relations. .....**MARCH 19-21, 1962.**

ASTM ANNUAL MEETING—Annual Meeting of the American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa., at Statler Hotel, New York City, in conjunction with apparatus exhibit. .....**JUNE 24-29, 1962.**

Canadian Degree-Days for February, 1961*

City	February 1961	February Normal	Cumulative 1961	Cumulative Normal
Calgary, Alta.	1123	1350	5814	6540
Charlottetown, P.E.I.	1409	1370	5927	5680
Crescent Valley, B. C.	886	1080	5327	5660
Edmonton, Alta.	1332	1520	6565	7370
Fort William, Ont.	1375	1580	7094	7370
Grande Prairie Alta.	1495	1600	6995	7720
Halifax, N. S.	1153	1180	4889	4955
London, Ont.	1095	1210	5305	5210
Medicine Hat, Alta.	1076	1380	5634	6380
Moncton, N. B.	1375	1380	6125	6000
Montreal, P. Q.	1252	1430	5866	6060
North Bay, Ont.	1329	1530	6649	6860
Ottawa, Ont.	1256	1450	6032	6300
Penticton, B. C.	753	960	4434	4740
Prince George, B. C.	1070	1320	6242	6650
Quebec, P. Q.	1420	1510	6658	6660
Regina, Sask.	1502	1680	6859	7770
Saint John, N. B.	1311	1310	5929	5800
Saskatoon, Sask.	1486	1710	7254	7950
Timmins, Ont.	1531	1680	7724	7870
Toronto, Ont.	999	1147	4779	4918
Vancouver, B. C.	601	740	3458	3750
Victoria, B. C.	590	660	3320	3430
Windsor, Ont.	1007	1100	4792	4760
Winnipeg, Man.	1490	1714	7408	7737

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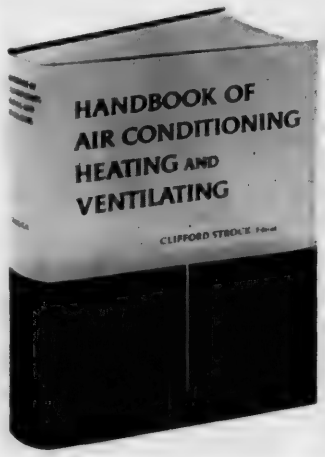

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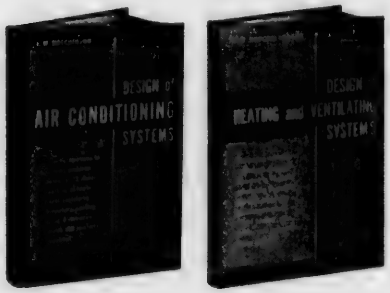

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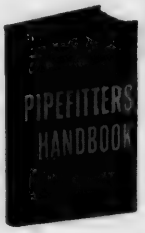

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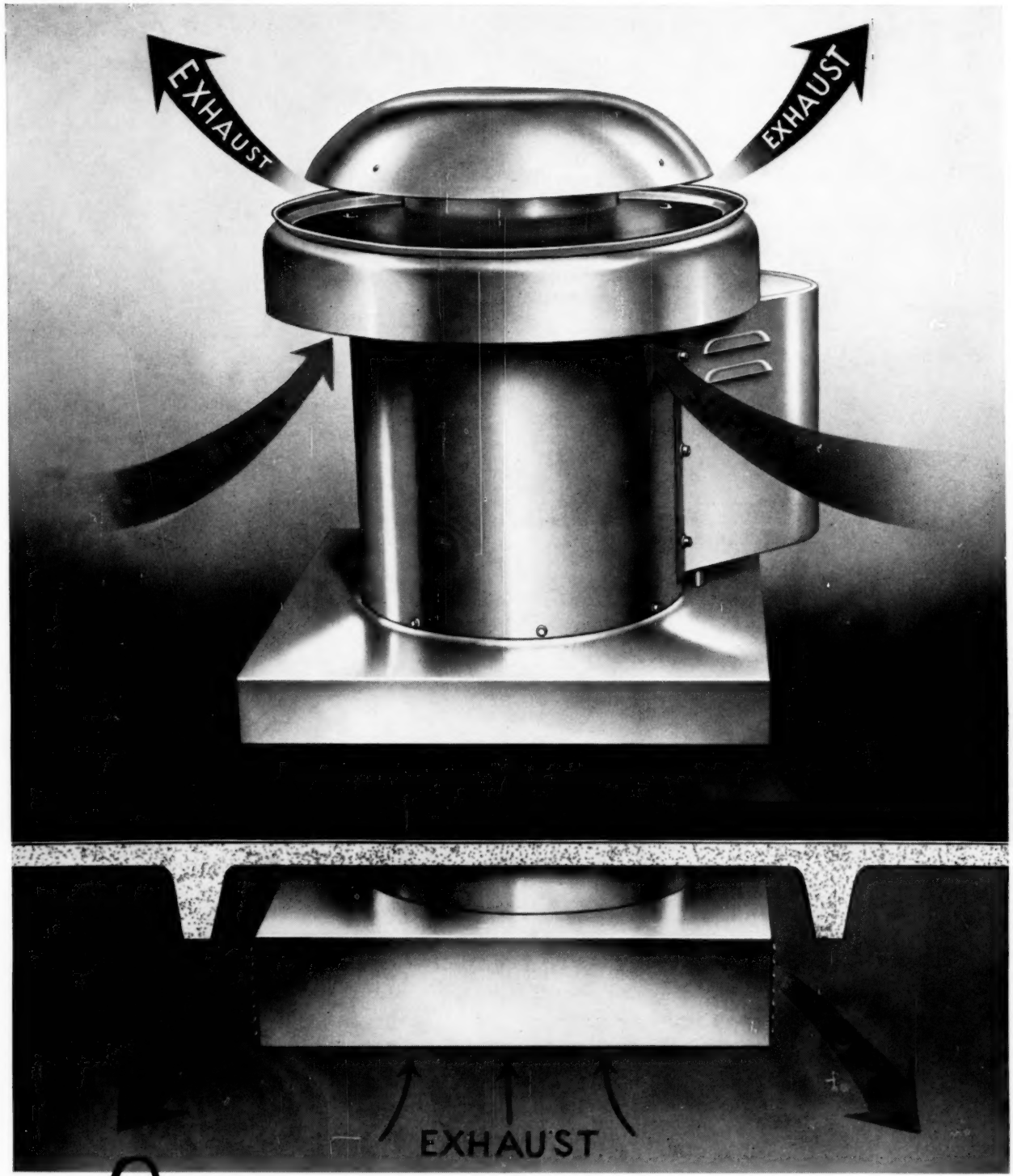

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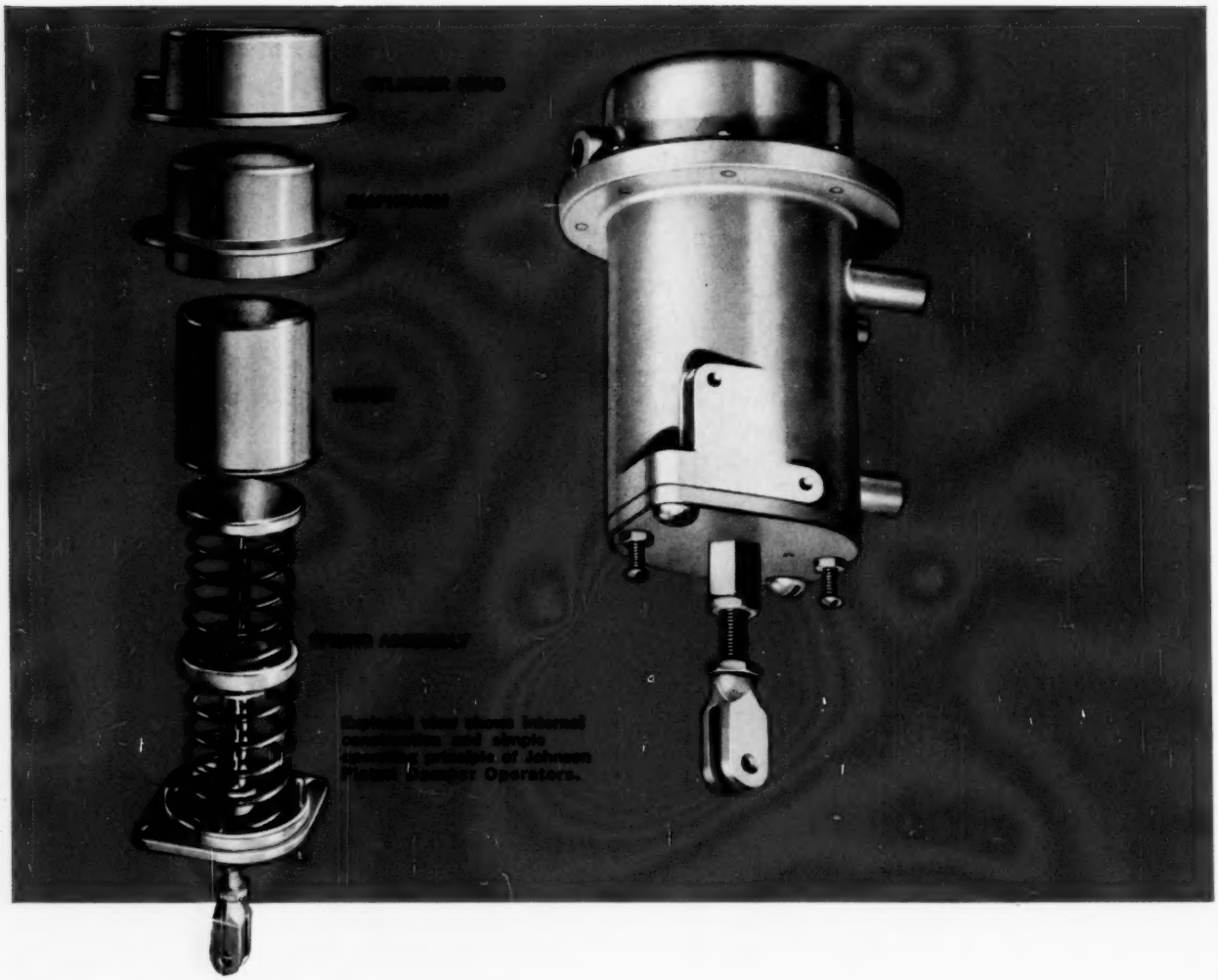

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